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# The Economic Analysis of Effluent Guidelines on the Feedlots Large Scale Segments

**Development Planning and Research Associates, Inc, Manhattan, KS**

**Prepared for**

**Environmental Protection Agency, Washington, D C Office of Planning and Evaluation**

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The large scale feedlot industry is composed of beef, hog, dairy, sheep, layer, broiler, turkey and duck operations. For each segment, the following minimum capacity listing indicates what sizes of feedlot are defined as large scale:

| Industry Segment | Minimum Capacity (No. of Head) |
|---|---|
| Beef cattle | 1,000 |
| Hogs | 2,500 |
| Dairy cattle | 700 |
| Chickens: Eg Layers | 30,000 |
| Chickens: Broilers | 37,500 |
| Turkeys | 55,000 |
| Sheep | 10,000 |
| Ducks | 5,000 |

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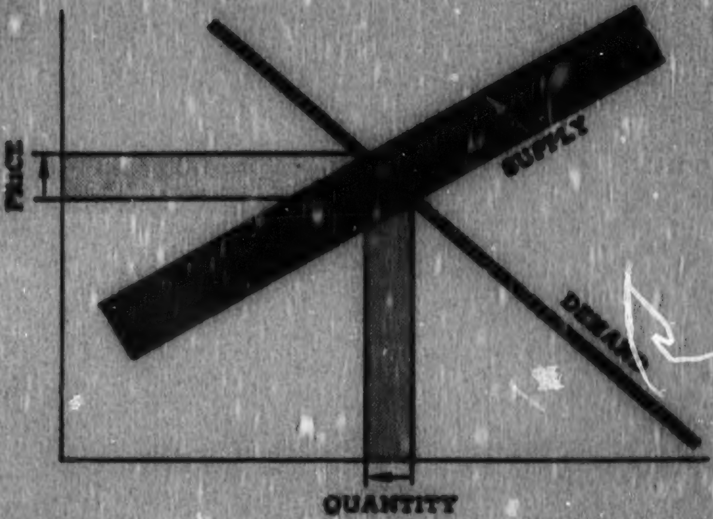
# ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES

# THE FEEDLOTS INDUSTRY
## LARGE SCALE SEGMENTS



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## 16. Abstracts (continued)

Feedlots included in the study represent a small percentage of all feedlots but account for a significant portion of livestock and poultry marketings. Estimated after-tax return on sales range from 2 percent for cattle and layer operations to 7 percent for hog operations, with the majority of operations ranging between 2 and 5 percent. With the exception of dairymen, practically all producers are price-takers; dairymen do have some collective bargaining power.

Imposition of effluent limitations is expected to impact primarily the large beef, hog, dairy and turkey operations. Beef, hog, and turkey prices are not expected to increase immediately because of a lack of bargaining power; milk prices, in the short-run, will increase less than one percent. In the long-run, price increases will be minor and should be between 1 and 1.5 percent. With effluent controls, most operations will still maintain positive net present values, although major declines appear for 1,000 hd. beef feedlots and both sizes of turkey feedlots evaluated. Cash flows were not seriously affected. Employment and community impacts will be slight as no closures of feedlots are projected to arise from implementation of controls.

The impact analysis is based upon a number of assumptions and cost estimates which are identified.

EPA - 230/2-76-008

# THE ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES ON THE FEEDLOTS INDUSTRY: LARGE SCALE SEGMENTS

Task Order No. 19--BOA No. 68-01-1533

Prepared for
Office of Planning and Evaluation
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Washington, D.C. 20460

February, 1976

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# ATTACHMENT I

## Preface

The attached document is a contractor's study prepared with the supervision and review of the Office of Planning and Evaluation of the U.S. Environmental Protection Agency (EPA). Its purpose is to provide a basis for evaluating the potential economic impact of effluent limitations guidelines and standards of performance established by EPA pursuant to sections 304(b) and 306 of the Federal Water Pollution Control Act.

The study supplements an EPA technical "Development Document" issued in conjunction with the promulgation of guidelines and standards for point sources within this industry category. The Development Document surveys existing and potential waste treatment and control methods and technologies within this category and presents the investment and operating costs associated with various control technologies. This study supplements that analysis by estimating the broader economic effects (including product price increases, continued viability of affected plants, employment, industry growth and foreign trade) of the required application of certain of these control technologies.

This study has been submitted in fulfillment of Contract No. 230/2-76-008, Task No. 68-01-1533 by DPRA. Work was completed as of February, 1976. The study is based primarily upon an earlier study, also prepared by DPRA entitled "Economic Analysis of Proposed Effluent Guidelines for the Feedlots Industry, Large Scale Segments Industry". The earlier report was circulated in conjunction with the publication of the Federal Register of a notice of proposed rulemaking under sections 304(b) and 306 for the subject point source category. The analysis contained in the original study has been updated based upon information received during the period of time between publication of the notice of proposed rulemaking and the promulgation of the final regulation. Because of the constraints of time, the control and treatment costs analyzed in this study may not in all instances be identical to those associated with the requirements of the promulgated regulation. However, those differences, when they exist are minor insofar as the final conclusions of the study are concerned.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulation, and other materials in the establishment of final effluent limitations guidelines and standards of performance.

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# EXECUTIVE SUMMARY

## BACKGROUND

### 1. Purpose of Study

The report which follows is an analysis of the potential economic impacts of the EPA effluent guidelines on large feedlot operations. The analysis provides a basis for evaluating the potential impacts of pollution controls on the financial condition of feedlot operators, on livestock and poultry products prices, on production and employment and on related community and national interests.

The study has been prepared under the supervision and review of the Office of Planning and Evaluation of the U.S. Environmental Protection Agency (EPA), consistent with the requirements of the Federal Water Pollution Control Act Amendments of 1972.

Implementation of Sections 304 and 306 of the Federal Water Pollution Control Act requires that regulations for the control of effluents from feedlots of all types be developed and that effluent guidelines be established to meet federal clean water standards. These guidelines have been proposed in a separate development document. Prior to the imposition of the guidelines, it is necessary to evaluate their various impacts on the feedlots industry and the national economy.

### 2. Effluent Guidelines

Proposed effluent guidelines for the feedlots industry require no discharge of process wastewaters to navigable water bodies by July 1, 1977, for all animal types except ducks, except for the run-off from precipitation events in excess of the 10-year, 24-hour storm for the feedlot location. Duck growing will have to meet a limitation on BOD and bacterial pollutants, using biological treatment. By 1983, feedlots for all animal types must meet the no-discharge standard, except for the precipitation runoff events in excess of the 25-year, 24-hour storm for the feedlot location. The 1983 standard applies to all new feedlot sources, effective January 1, 1974.

These proposed effluent guidelines are to be achieved through the use of the "Best Practical Control Technology Currently Available" for 1977 and the "Best Available Technology Economically Achievable" for 1983. In essence, the technology consists of run-off containment ponds and the equipment necessary for the systematic application of wastes to cropland.

## 3. Scope and Organization of the Study

The final report consists of the following sections:

I. Industry segments--a comprehensive data base for each type of animal feedlot which includes the size, location, and number of enterprises by technology employed.

II. Financial profiles--model (representative) feedlots for each animal-type (except sheep and ducks) are included to estimate profitability, cash flows, capital structures, cost structures, and the ability to finance new investments.

III. Pricing--an analysis of price determinants in the industry and the presentation of demand and supply data for each segment.

IV. Economic impact methodology--an explanation of the fundamental methodology used in the impact analysis to estimate price, financial, production, employment, community and other related effects of pollution controls.

V. Cost of pollution control--a review of waste treatment technology in the various segments and a summary of investment and operating costs for pollution control technologies.

VI. Impact analysis--estimates of expected price changes, effects on profitability of the various model feedlots, possible feedlot closures as a result of pollution controls and employment, community and other related effects.

VII. Limits of the analysis--recognition of ranges of variances in economic data, parameters and estimates, a summary of critical assumptions used in the analysis, and an examination of questions remaining.

# I. INDUSTRY SEGMENTS

This study is limited in scope to the large-scale operation of each of the following segments:

| Industry Segment | Minimum Capacity (No. of Head) |
|---|---|
| Beef cattle | 1,000 |
| Hogs | 2,500 |
| Dairy Cattle | 700 |
| Chickens: Egg Layers | 30,000 |
| Chickens: Broilers | 37,500 |
| Turkeys | 55,000 |
| Sheep | 10,000 |
| Ducks | 5,000 |

Operations below these minimum sizes are the subject of a separate study and will be referred to in this report only as necessary to provide industry perspective.

## A. Types of Enterprises

### 1. Size and Number

The feedlots included in this study represent a relatively small percentage of all feedlots, but they account for a significant portion of livestock and poultry marketings. These relationships are summarized in Table 1.

In several instances, data were not available categorizing feedlots according to the sizes specified in this study. This is especially significant for hogs and dairy cattle. This study's cut-off point for hogs is the 2,500-head capacity operation, whereas the Census data give a breakdown at the 1,000-head level. There may be as few as 250 producers with 2,500-head or more capacity. Dairy cattle categories also differ. The smallest unit included in this study is a 700-head operation. Census data provide no breakdown above 200 head; however, there are few operators at 700 head or above.

Large operators are most numerous in chicken broiler production; 22.7 percent of the producing units in 1969 fed at least 20,000 birds. Large producers are least important as a percent of total production in hogs and dairy cattle where they account for only 6.8 and 8.5 percent of all animals produced. In all other segments, large producers have major shares of production, ranging from 31.4 percent for turkeys up to 84.0 percent for ducks.

Table 1. Number of feedlots and share of production by segment, 1969

| Industry Segment | Capacity No. Head | Feedlots No. Units | Percent of Total | No. Head (000) | Percent of Total |
|---|---|---|---|---|---|
| Fed cattle[1/] | 1,000 up | 2,107 | 1.4 | 16,560 | 61.7 |
| Hogs | 1,000 up | 2,443 | 0.5 | 3,763 | 6.8 |
| Dairy cattle | 200 up | 2,486 | 0.4 | 947 | 8.5 |
| Sheep | 1,000 up | 3,690 | 3.0 | n.a. | 50.5 |
| Chickens: Egg layers | 20,000 up | 3,128 | 1.1 | n.a. | 47.7 |
| Chickens: Broilers | 20,000 up | 7,634 | 22.7 | 1,424,501 | 58.7 |
| Turkeys | 50,000 up | 140 | 2.6 | 32,516 | 31.4 |
| Ducks | Large[2/] | 147 | 2.9 | 11,911 | 84.0 |

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[1/] 1972 data from Cattle on Feed, U.S.D.A., S.R.S. All other data for 1969 from Census of Agriculture.

[2/] Breakdown reported simply in terms of large and small producers in 1969 Census of Agriculture

In all segments, the trend is toward larger operations as smaller producers give way to larger ones. The market share of the larger units has also risen.

Feedlot enterprise may be specialized commercial feeding operations or farmer-feeder operations. By definition, cattle feeders with a capacity of at least 1,000-head are designated commercial. Large hog feeding units are generally parts of farming enterprises. Large dairy units are usually highly specialized (a few may be parts of farming operations). Sheep production is usually part of diversified farm or ranch enterprise. Large egg producers are highly specialized operators. The largest broiler operations are generally the sole enterprise, although some operators at the lower end of the large-scale range may have other employment. Large turkey feeding units and the largest duck feeding enterprises are highly specialized.

## 2. Technology, Efficiency, and Age

Technological improvements in feedlots have been generally adopted by large-scale operators in all segments. Improved feed-handling systems and nutritional gains have contributed to increased efficiency.

Large-scale cattle feeding requires automated, bulk-feed handling systems designed to reduce the per unit costs of feeding. The technologies used may vary in detail, but they are generally similar, consisting of on-site feed mills and conveyor-type distribution systems.

Hog feeders may employ either a paved or unpaved open-lot system, a fenced pasture system, or a total confinement system. The latter system is the most capital intensive, with gains in labor productivity offsetting higher capital costs. Very large units generally have automated feeding systems.

Dairy farms may use an open-lot system, a free-stall system or the older, stanchion barn system. Investments in the newer technologies are substantial when compared to those of the older, smaller units. These higher capital costs are offset by greater productivity per dairy cow under improved management systems.

Large broiler and egg producers tend to utilize the latest technologies and are generally more efficient than the smaller operators. Size of flocks has been increasing rapidly. Automated equipment for feeding and for egg-handling have reduced industry labor costs.

Large sheep units do not employ as sophisticated a technology as do hog and cattle feeders, but limited use is made of advanced feed handling systems. In general, though sheep feedlots are similar to cattle feedlots, they probably have a lower technological level.

Turkey growers apparently have adopted fewer new management and feeding technologies than have other operators and producer efficiency varies greatly.

Large duck feeding operations, either wet- or dry-lot systems, probably utilize reasonably advanced systems of feed handling and management.

Precise data on age of production facilities are not available for any of the segments. (Some generalized information for Texas and Oklahoma cattle feedlots indicates an age of 10 to 15 years for many of the large-scale units.) The very large hog feedlots, especially total confinement operations, are probably 10 years or less in age. Large operations average 12 years of age. Poultry facilities are estimated at about 10 years (one half the life of buildings). Sheep facilities are to be older--15 to 20 years.

## 3. Integration and Diversification

Feedlots are a part of a seven stage production chain: (1) grain production for feed, (2) feed milling, (3) breeding, (4) feeder animal production, (5) feeding, (6) processing, and (7) wholesale and retail distribution. The precise extent of integration is not known, but some generalizations are possible.

Cattle feeding operations range from highly specialized units to totally integrated enterprises. Some may also be diversified into grain production for sale and for the production and marketing of other livestock products. Integrated operators include farmers, agricultural businesses, meat packers, livestock marketing agencies and food retailers.

Large-scale feeding operations are generally the primary farm enterprises of their operators, but operators vary in the extent to which they produce their own feeder pigs.

Some vertical integration exists in dairying from grain and herd production through processing and distribution. The percentage of total milk produced by integrated operators is very small.

Vertical integration in egg and broiler production is substantial, with both backward and forward integration present. An estimated 55 percent of egg and 95 percent of broiler productions are under some type of integrated arrangement. Turkey and ducks also exhibit similar tendencies.

Nearly all sheep feeding is by independent producers, with integration basically limited to the feeders producing their own breeding and feeding animals.

## B. Location of Major Production Segments

The location and numbers, by leading states, of large-scale feedlots for each segment is reported below.

| Fed Cattle (1,000 head or more) | No. Feedlots |
|---|---|
| Texas | 230 |
| Nebraska | 543 |
| Colorado | 191 |
| California | 214 |
| Kansas | 131 |
| Arizona | 46 |
| Oklahoma | 41 |
| Iowa | 90 |
| Idaho | 88 |
| New Mexico | 43 |

| Hogs (1,000 head or more) | No. Feedlots |
|---|---|
| Iowa | 1,453 |
| Illinois | 1,299 |
| Indiana | 804 |
| Missouri | 491 |
| Ohio | 333 |
| North Carolina | 270 |
| Minnesota | 269 |
| Nebraska | 244 |
| Kentucky | 156 |
| Wisconsin | 116 |

| Dairy Cattle (100 head or more) | No. Feedlots |
|---|---|
| California | 2,104 |
| Texas | 781 |
| New York | 742 |
| Wisconsin | 322 |
| Pennsylvania | 297 |
| Michigan | 263 |
| Ohio | 184 |
| Kentucky | 109 |
| Minnesota | 98 |
| Iowa | 82 |

| Sheep (5,000 or more) | No. Feedlots |
|---|---|
| Wyoming | 87 |
| California | 77 |
| Texas | 66 |
| Idaho | 36 |
| Colorado | 32 |
| Utah | 25 |
| Montana | 13 |
| Oregon | 11 |
| South Dakota | 6 |
| Iowa | 2 |

| Egg Layers (20,000 or more | No. Feedlots |
|---|---|
| California | 466 |
| Georgia | 358 |
| Florida | 214 |
| Arkansas | 193 |
| Texas | 165 |
| North Carolina | 159 |
| Alabama | 149 |
| Indiana | 142 |
| Pennsylvania | 118 |
| Minnesota | 33 |

| Broilers (20,000 or more) | No. Feedlots |
|---|---|
| Arkansas | 1,278 |
| Georgia | 1,078 |
| North Carolina | 855 |
| Alabama | 720 |
| Mississippi | 720 |
| Texas | 505 |
| Maryland | 557 |
| Delaware | 348 |
| Virginia | 169 |
| Maine | 265 |

| Turkeys (50,000 or more) | No. Feedlots |
|---|---|
| Minnesota | 28 |
| California | 16 |
| Texas | 10 |
| Virginia | 6 |
| Arkansas | 5 |
| Missouri | 5 |
| Ohio | 3 |
| Indiana | 2 |

Ducks (large producers) - Five states produce 84 percent of all ducks. Large producers (5,000 and up) are not identified by numbers in any published sources, but they are assumed to be located in the five leading states: New York, Indiana, Wisconsin, California and Illinois.

## C. Employment

Published data on feedlot employment were unavailable. Estimates were made for each segment based on the number of large producers in each size category and the assumed manpower requirements for the various model feedlots. The employment data are ambiguous because of the extensive use of family labor in some enterprises (especially hogs, dairy and poultry). Table 2 presents these employment estimates.

Table 2. Summary of estimated industry employment.

| | Number large producers | Total Number employed | Number hired | Total Industry employment [1] |
|---|---|---|---|---|
| Cattle (1972) | 2,107 | 12,313 | 9,000 | 164,562 |
| Hogs (1972) | 2,443 | 12,000 | 8,000 | 908,000 |
| Dairy (1969) | 2,486 | 18,900 | 13,900 | 518,900 |
| Sheep (1969) | 3,690 | 10,000 | 3,000 | 150,000 |
| Layers (1969) | 3,128 | 6,453 | 1,500 | 43,616 |
| Broilers (1969) | 7,634 | 10,000 | - | 36,054 |
| Turkey (1969) | 140 | 650 | 350 | 6,929 |
| Ducks (1969) | 147 | 441 | 100 | 5,300 |

---

[1] Many of those indicated in the total industry employment figure are only partially employed.

# II. FINANCIAL PROFILE

Little published financial data exist for feedlot operations. Economic studies in certain states were relied on heavily for investment, costs and financial returns in the various industry segments. These were used, along with information from industry sources, to construct model (representative) feedlot budgets.

## A. Plants by Segment

Model feedlots were constructed for all segments, except sheep and ducks, where insufficient data presented reasonable estimates. The model feedlot configurations are shown in Table 3.

### 1. Annual Profits and Cash Flows

A pro forma income and expense statement, based on 1971 costs and prices, was prepared for each model feedlot. Economic data for 1971 were chosen to reflect more stable cost-price relationships than those which prevailed in 1972-73. Profits and cash flows are summarized in Table 4.

The broiler segment reports only pre-tax income, representing returns to family labor and invested capital for the model operation reflects that of a contract grower using family labor to supplement other income.

### 2. Market (Salvage) Value of Assets

Estimated replacement values of feedlot fixed assets were based on 1971 costs. Salvage values were derived from replacement costs and reflect alternative uses and type of facilities. Land values, generally a small part of total investment, were excluded from both replacement and salvage values. Table 5 summarizes investment costs and salvage values.

### 3. Capital Structure

Estimates of the ratio of equity capital to debt capital were developed for each segment and were based upon published studies and industry sources. The ratios were used to estimate interest costs for model feedlots. Equity inputs for both long-term capital and working capital vary substantially among segments and partially reflect the credit conditions and financial records of the segments.

### 4. Cost Structure

The pro forma model feedlots statements show the variations in direct and indirect costs among segments. Major direct costs were for animals and feed. For beef feedlots, cattle purchases represented 65 percent of

Table 3. Model feedlot sizes utilized for financial profiles

| Industry segment (capacity) | Industry segment (capacity) |
|---|---|
| Fed cattle | Egg-layers |
| 1,000 | 30,000 |
| 5,000 | 50,000 |
| 10,000 | 100,000 |
| 20,000 | |
| Hogs | Broilers (Ga. & Maine) |
| 2,500 | 37,500 |
| Dairying | Turkeys |
| 700 | 55,000 |
| 1,000 | 100,000 |

Table 4. Estimated income and cash flow for industry segments based on model feedlots, 1971

| Feedlot configuration | No. head | Pre-tax | | | After-tax | | | Cash flow | |
|---|---|---|---|---|---|---|---|---|---|
| | | Income | ROI | ROS | Income | ROI | ROS | Income | Percent Investment |
| **Fed Cattle** | | ($000) | (pct) | (pct) | ($000) | (pct) | (pct) | ($000) | |
| | 1,000 | 18 | 12 | 3 | 14 | 10 | 2 | 16 | 9 |
| | 5,000 | 91 | 14 | 3 | 54 | 9 | 2 | 63 | 8 |
| | 10,000 | 229 | 19 | 3 | 126 | 10 | 2 | 143 | 9 |
| | 20,000 | 517 | 21 | 4 | 275 | 11 | 2 | 306 | 13 |
| **Hogs** | | | | | | | | | |
| | 2,500 | 19 | 14 | 8 | 15 | 11 | 7 | 24 | 17 |
| **Dairying** | | | | | | | | | |
| | 700 | 36 | 8 | 5 | 25 | 5 | 4 | 30 | 7 |
| | 1,000 | 78 | 12 | 8 | 47 | 7 | 5 | 53 | 8 |
| **Egg-layers** | | | | | | | | | |
| | 30,000 | 4 | 9 | 2 | 3 | 7 | 2 | 6 | 13 |
| | 50,000 | 9 | 12 | 3 | 7 | 10 | 2 | 12 | 16 |
| | 100,000 | 24 | 17 | 4 | 19 | 13 | 3 | 29 | 20 |
| **Broilers** | | | | | | | | | |
| Georgia | 37,500 | 5 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Maine | 37,500 | 6 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Turkeys** | | | | | | | | | |
| | 55,000 | 9 | 5 | 2 | 7 | 4 | 2 | 22 | 12 |
| | 100,000 | 16 | 5 | 2 | 13 | 4 | 2 | 40 | 12 |

Table 5. Investment and salvage values by industry segment and feedlot size

| Segment | Capacity No. head | Fixed investment (replacement) | Salvage values | Net working capital | Total salvage value |
|---|---|---|---|---|---|
| | | -------- $000 | ------------- | ------------- | ------------- |
| **Fed cattle** | | | | | |
| | 1,000 | 77 | 7.7 | 107 | 114.7 |
| | 5,000 | 304 | 30.4 | 478 | 508.4 |
| | 10,000 | 560 | 56.0 | 948 | 1,004.0 |
| | 20,000 | 1,040 | 104.0 | 1,890 | 1,994.0 |
| **Hogs** | | | | | |
| | 2,500 | 187 | 37.7 | 45.0 | 82.7 |
| **Dairying** | | | | | |
| | 700 | 577 | 213.0 | 55.0 | 268.0 |
| | 1,000 | 810 | 302.6 | 78.0 | 380.6 |
| **Egg-layers** | | | | | |
| | 30,000 | 63 | 6.3 | 13.0 | 19.3 |
| | 50,000 | 104 | 10.4 | 21.0 | 31.4 |
| | 100,000 | 205 | 20.5 | 42.0 | 62.5 |
| **Broilers** | | | | | |
| Georgia | 37,500 | 57 | 5.7 | 1.4 | 7.1 |
| Maine | 37,500 | 71 | 7.1 | 1.4 | 8.5 |
| **Turkeys** | | | | | |
| | 55,000 | 303 | 30.3 | 34.2 | 64.5 |
| | 100,000 | 551 | 55.1 | 60.7 | 115.8 |

sales, and other segments showed animal costs varying from 14 to 24 percent of sales. Feed costs were high in all segments, ranging from 25 percent of sales for cattle up to 62 percent of sales for hogs. Most feed costs ranged from 46 to 62 percent of sales.

Indirect costs, including depreciation and long-term interest, were also estimated. These were relatively minor in most segments, except for broiler production where sales do not represent final market prices of birds but rather the contract rate for feeding.

## B. Ability to Finance New Investments

The ability to finance new investment to install pollution controls depends, in part, upon the profitability of the enterprise, its credit rating, the financial resources of the operator, and the availability of funds from lending agencies. These conditions vary by geographic area and among operators within segments and regions.

Some broad generalizations are possible as a result of the model plant analysis and a consideration of agricultural credit in general.

Fed cattle operations appear to have adequate returns and cash flows and should experience little difficulty in financing new investment under similar conditions. Production Credit Association, Farmers Home Administration and commercial banks have furnished credit in the past and should continue to do so. Internally generated funds can provide much of the new capital. The cyclical nature of the industry can seriously impair the ability to finance in any given year. Sharply different conditions could change the financial outlook for this segment.

Hog producers, as represented by a 2,500 capacity feedlot, show a reasonable after tax profit and cash flow as a percent of investment. Sources of credit are similar to cattle feedlot operations and show somewhat similar limitations based upon operator profitability and resources. Hog producers can apparently finance new investments of reasonable magnitude, but excessive new investment requirements could tax the ability of these large producers.

Dairy operations, as represented by the model feedlots, show only moderate returns on investment. Such operators might find it difficult to raise large sums of money in tight credit markets. Large operators with newer facilities may generate sufficient cash flows to finance new investment internally. Operators with good credit ratings should be able to borrow additional investment funds; weaker operators could encounter trouble.

Poultry producers vary in their ability to finance new investments. Large egg producers show reasonable returns with adequate cash flows and should experience little difficulty. Broiler and turkey producers, on the other hand, will be limited somewhat by their personal resources and credit ratings. Marginal operators will undoubtedly encounter difficulty in borrowing. Turkey growers with high cash flows can do some limited financing through internally generated funds.

# III. PRICING

## A. Price Determination

Supply and demand forces determine livestock and poultry feedlot prices. Producers are price takers, not price setters; no operator is large enough to influence the market through independent action.

A major exception is milk pricing for dairy operators. Federal and state programs fix minimum prices and terms of sales. Prices are also affected by federal dairy supports and by dairy cooperatives' area bargaining.

## B. Demand

Figures 1 and 2 depict consumption trends of livestock and poultry products from 1950 to 1971. The quantity consumed reflects both supply and demand factors.

Per capita consumption of beef, chickens and turkeys has risen; pork has fluctuated around a fairly level trend line; eggs and fluid milk per capita consumptions have declined.

Demand projections were based on population changes and per capita consumption levels. Population growth has been projected to be between 10 to 14 percent from 1970 to 1980. Beef and chicken per capita consumptions are expected to continue rising but at slower rates. Pork is projected to remain stable on a per capita basis, while the consumption of eggs is projected to remain fairly constant or decrease slightly. Turkeys should continue a steady, modest increase in per capita consumption. Fluid milk is expected to continue its per capita consumption decline.

The demand for livestock and poultry products is estimated to be more inelastic at the farm level than at the retail level. Estimates are as follows:

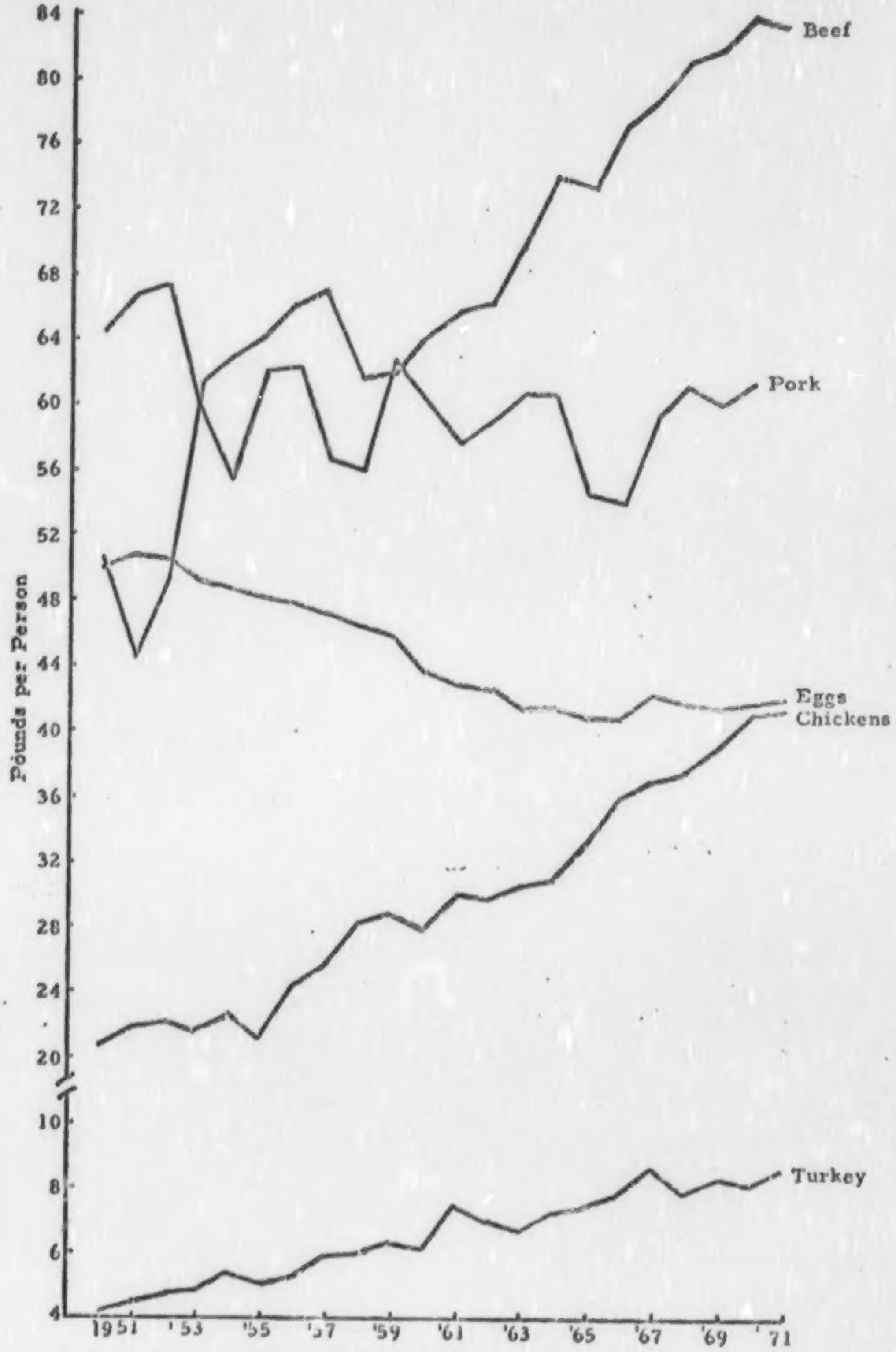

Figure 1. Per Capita Consumption

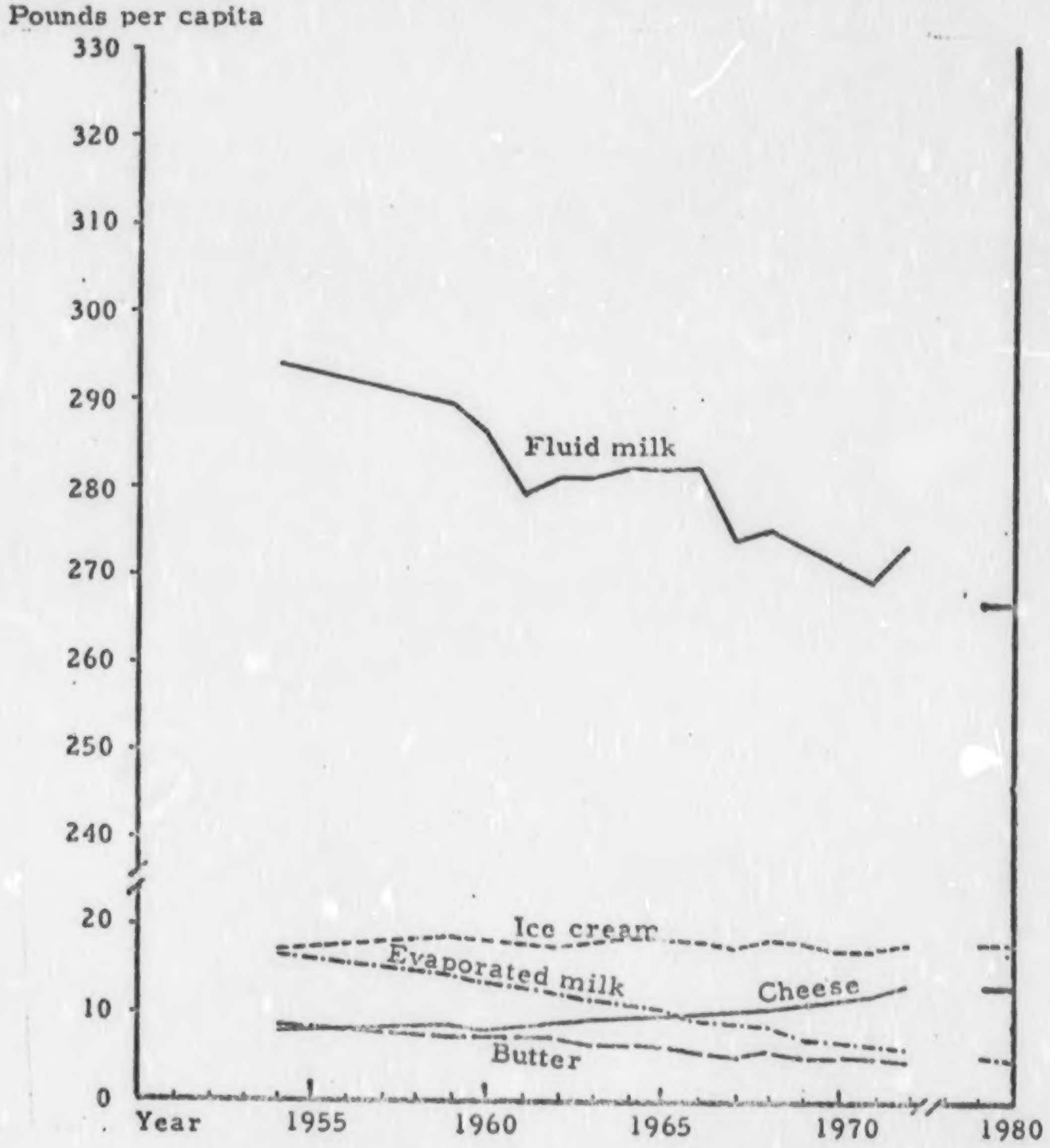

Figure 2. Per capita consumption of selected dairy products in the U.S. for selected years 1954-1972, with a forecast to 1980.

Note: 1972 Data are preliminary
Fluid milk consumption is based on the product weight of the Economics Research Service, USDA Research Series.

Source: George, P.S. and G. A. King. Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph #26, March, 1971, University of California.

| | Price Elasticity of Demand-Farm Levels |
|---|---|
| Beef | -0.416 |
| Pork | -0.241 |
| Lamb and mutton | -1.670 |
| Chickens | -0.602 |
| Turkey | N.A. |
| Eggs | -0.225 |
| Milk | -0.323 |
| Duck | N.A. |

Source: George, P.S. and G. A. King. Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph #26, March, 1971. University of California.

The demand for lamb and mutton is most responsive to price changes at the farm level. A one percent increase in price reduces the quantity demanded by 1.67 percent. Chickens are next with a price elasticity of -0.602. Price elasticity for beef demand, at the farm level, is -0.416, indicating that a one percent decline in price would result in a 0.4 percent increase in the quantity demanded. With inelastic demand coefficients, a small decrease in the quantity offered by producers will result in a large percentage increase in price at the farm level.

## C. Supply

The supply of slaughter cattle, hogs, and dairy cattle, though more elastic over longer periods, is highly inelastic in the short-run. Both cattle and hogs have cyclical supply patterns (10-12 years for cattle and 4 years for hogs) which show supply responses to market conditions. The supply curve for cattle has shifted outward from about 21 billion pounds sold in 1950 to over 40 billion pounds in 1971. Hogs have remained fairly constant, fluctuating from about 17 billion to 23 billion pounds over the same time span. Broiler sales have expanded rapidly from 2 billion to almost 11 billion pounds, while turkey sales have risen from just under a billion pounds in 1950 to about 2.3 billion pounds in 1971. Eggs have been fairly stable with a steady increase from 7.7 billion pounds to 9.4 billion pounds. Although the number of farms and dairy cows have declined steadily, milk supply has remained fairly constant.

## IV. ECONOMIC IMPACT ANALYSIS METHODOLOGY

Impact analysis will include the following:

Price effects
Financial effects
Production effects
Employment effects
Community effects
Other effects

### A. Fundamental Methodology

Figure 3 schematically presents the methodology used in the impact analysis.

The core conceptual data were the physical and financial characteristics of the various industry segments as projected on the basis of the model plants presented in Chapter II.

The primary factors involved in assessing the financial and production impact of pollution control were profitability changes and the ability of feedlots to pass along increased costs in higher prices. In reality, of course, closure decisions are seldom made on the basis of well-defined common economic rules; such decisions invariably include a wide range of personal values, external forces such as the ability to obtain financing, or the role of the production unit in an integrated larger cost center.

Given known pricing conditions, the impact on profitability of pollution control costs and the resulting prices are generally determined by employing the ROI (or any other) profitability measure under the conditions of the new price and the incremental investment in pollution control. The primary consequence of profitability changes is a firm's decision to finance increased costs or to discontinue operations.

In the most fundamental case, a plant will close if variable expenses (Vc) are greater than revenues (R). However, in practice, plants may continue to operate where Vc > R under certain conditions.

A more probable situation is the case in which VC < R but revenues are less than variable costs plus fixed, short-run cash overhead expenses (TCc). In this situation a plant would likely continue to operate as contributions are being made toward covering a portion of these fixed cash overhead expenses. The firm cannot operate indefinitely under this condition. In the present analysis, the identification of plants where TCc > R, but Vc < R led to an estimate of plants that should eventually close if revenues do not increase. The timing of such closures, however, is difficult to predict.

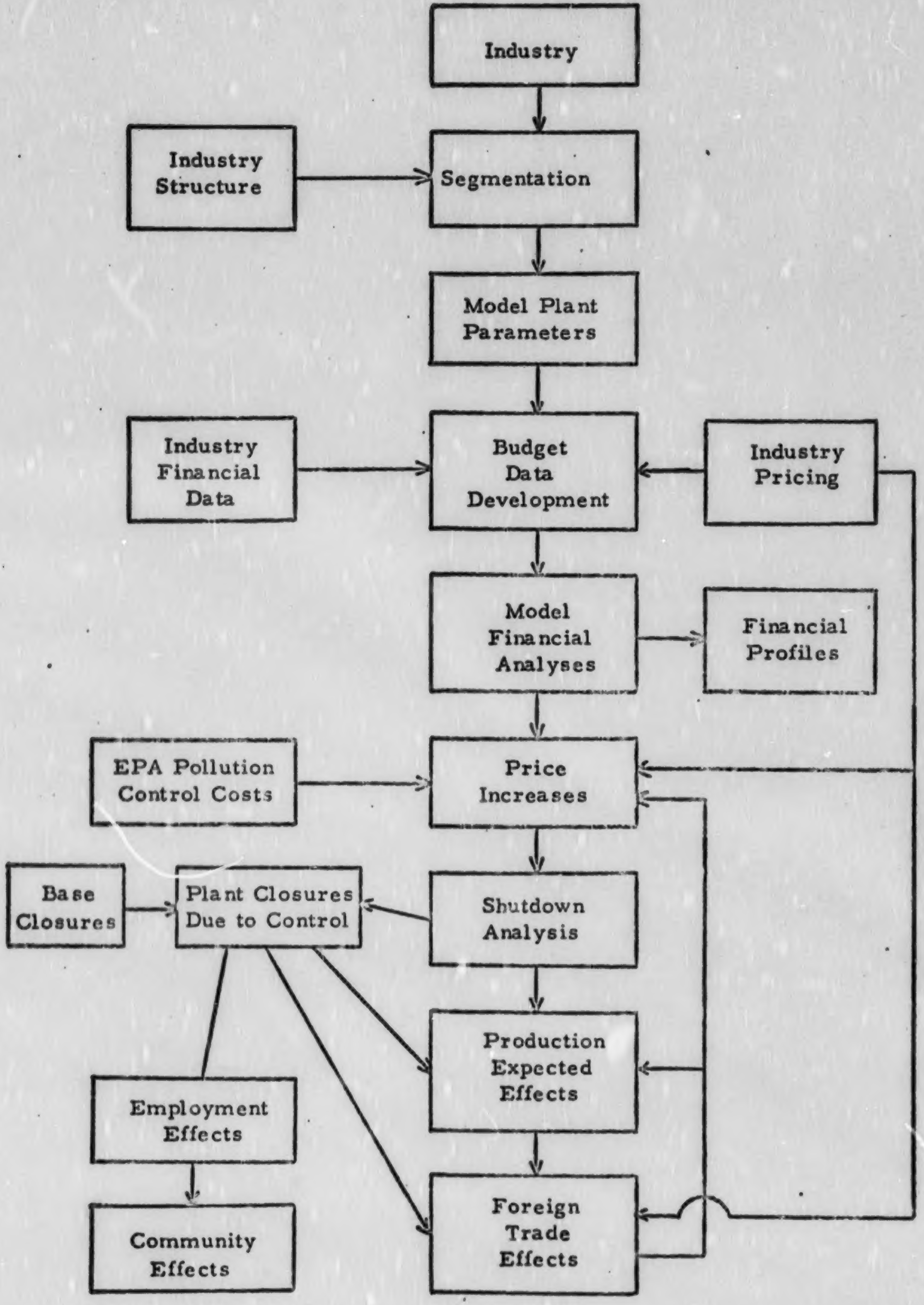
Industry
Industry Structure
Segmentation
Model Plant Parameters
Industry Financial Data
Budget Data Development
Industry Pricing
Model Financial Analyses
Financial Profiles
EPA Pollution Control Costs
Price Increases
Base Closures
Plant Closures Due to Control
Shutdown Analysis
Production Expected Effects
Employment Effects
Community Effects
Foreign Trade Effects

Figure 3. Schematic of impact analysis of effluent control guidelines.

The next level of analysis, where TCc < R, involved estimating the earnings before and after investment in pollution abatement. Under conditions in which TCc < R, it seems likely that investment in pollution control will be made and that plant operations will continue so long as the capitalized value of earnings (CV) (at the firm's cost of capital) is greater than the scrap or salvage value (S) of the sunk plant investment. If S > CV, the firm could realize S in cash and reinvest it more profitably. This presumes reinvesting at least at the firm's (industry's) cost of capital.

Computation of CV involved discounting the future earnings flow to present worth through the general discounting function:

$$V = \sum_{n=1}^{t} A_n(1+i)^{-n}$$

where

$V$ = present value
$A_n$ = a future value in $n^{th}$ year
$i$ = discount rate as target ROI rate
$n$ = number of conversion products, i.e., 1 year, 2 years, etc.

The two primary types of DCF measures of profitability were used. The first is the internal rate of return or yield, the computed discount rate (yield) which produces a zero present value of the cash flow. The yield is the highest rate of interest the investor could pay if all funds were borrowed and the loan were returned from the cash proceeds of the investment. The second DCF measure is the net present value concept. Rather than solve for the yield, a discount rate equivalent to the firm's cost of capital is used. Independent investments with net present values of above zero are accepted; those below zero are rejected. The concept of comparing capitalized earnings with the sunk investment value is a variation of the net present value method.

The data input requirements for book and DCF measures were derived, to a large extent, from the same basic information, although the final inputs were handled differently for each. One should no compare DCF rates directly with book rates.

### 1. Profitability

In this analysis, profits for the book analysis were called after-tax income; for the DCF analysis they were called after-tax cash proceeds. The computation of each is shown below:

After tax income = $(1-T)x(R-E-I-D)$

After tax cash proceeds = $(1-T)x(R-E-D)+D$

where

T = tax rate
R = revenues
E = expenses other than depreciation and interest
I = interest expense
D = depreciation charges

Interest was omitted in the cash proceeds computation since it is reflected in the discount rate, the after-tax cost of capital (see below). Depreciation was included in the DCF measure only in terms of its tax effect and it was then added back so that a cash flow over time was obtained.

## 2. Investment

In evaluating the closure potentiality of an on-going plant with sunk basic investment, the value of that investment is considered its liquidation or salvage value. Sunk investment was taken as the sum of fixed asset salvage value plus net working capital (current assets less current liabilities).

EPA estimates provided the pollution control investment measures.

The above discussion refers primarily to the DCF analysis. Investment for estimating book rates was considered to be the book value of assets plus net working capital.

## 3. Cost of Capital - After Tax

The cost of capital is defined as the weighted average of the cost of each type of capital employed by a firm, generally equities and interest bearing liabilities. For the feedlot industry, we have assumed a return on owners' investment of 8 percent and long-term interest of 7.5 percent. We have assumed an after-tax cost of debt of 3.9 percent (assuming a 48 percent tax rate), with an equity-debt structure of 60-40 percent of investment.

The weighted cost of capital is estimated as follows:

| | Percent of Investment | Cost | Weighted Cost |
|---|---|---|---|
| Equity | 60 | 8 | 4.80 |
| Debt | 40 | 3.9 | 1.56 |
| Weighted cost | | | 6.36 |

We have assumed a discount rate of 6.5 percent for the analysis.

### 4. Construction of the Cash Flow

The cash flow used in the impact analysis was constructed from sunk investment (salvage value), after-tax cash proceeds, incremental pollution control investment and incremental pollution control costs.

## B. Price Effects

The basis of price analysis, in general, is the premise that prices and supplies (production) are functionally related variables which are simultaneously resolved. In view of the complex diversity of factors involved in determining market price, a purely quantitative approach to the problem of price effects was not feasible for this study. The judgment factor was heavily employed in determining the supply response to a price change and the alternative price changes to be employed.

The required price increase was computed by the described DCF analysis. It dealt only with incremental pollution investment and cash proceeds.

The application of the above DCF procedure to these costs yielded the present value of pollution control costs (i.e., investment plus operating cost less tax savings). Wherever this was known, the price increase required to pay for pollution control was calculated by the formula

$$X = \frac{(PVP)\,(100)}{(1-T)\,(PVR)}$$

where:

$X$ = required percentage increase in price
$PVP$ = present value of pollution control costs
$PVR$ = present value of gross revenue starting in the year pollution control is imposed

## C. Financial Effects

The financial effects of pollution controls were evaluated in terms of their impact on the profitability and cash flows established in Chapter II. This analysis considered production effects, supply adjustments and anticipated price charges. Post-pollution control after-tax profits, cash flows and returns on investment were calculated. In addition, net present value estimations provided another measure of economic profitability.

Judgments were drawn concerning the ability of the various feedlot segments to finance the incremental investments for pollution control.

### D. Production Effects

Estimated plant closures were used to estimate employment effects.

### F. Community and Other Effects

Pollution control effects in terms of broad community interests resulting from shutdowns and loss of employment were also analyzed. Other effects, such as balance of payments, were subsequently analyzed.

## V. COST OF POLLUTION CONTROL

### A. State-of-Art in Pollution Control

Table 6, based on EPA data, indicates the percentages of those feedlot segments currently meeting BPT control standards. These are general estimates of the percentage of large-scale operators who had BPT technology in place in 1973.

Based on these estimates, four segments will require additional investment for pollution control: beef cattle, hogs, dairy cattle and turkeys.

Insufficient data on large duck and sheep producers necessitated omitting their segments from further analysis.

### B. Incremental Costs of Pollution Control

The estimated investment and operating costs for effluent controls for each segment were furnished by EPA. The systems assumed for each segment are shown in Table 7, and their investment and annual operating costs are summarized in Tables 8 and 9.

Certain basic parameters, established by EPA, were assumed for operating costs. Operations and maintenance expense was calculated at 5 percent of investment for lagoons and collection systems and at 10 percent for equipment. Depreciation was estimated at 5 percent of investment for lagoons and collection systems and at 20 percent for equipment. Annual interest charges of 7.5 percent on one-half the original investment approximated interest costs over the life of the investment.

Table 6. Estimated current effluent control status, feedlot industry

| | Meet Proposed Effluent Guidelines | Percent Meeting Effluent Guidelines |
|---|---|---|
| Broilers | Yes | 100 |
| Layers | Yes | 100 |
| Sheep | Yes | 100 |
| Ducks | */ | */ |
| Beef (1,000 head or more) | No | 60-70 |
| Swine | | |
| Dirt/open lot | No | 5-10 |
| Concrete/open lot | No | 75-80 |
| Totally confined | Yes | 100 |
| Dairy (dry lot) | No | 60-70 |
| Cow yards | No | 60-70 |
| Turkeys | No | Unknown |

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*/ No data available

Table 7. Effluent control system types by industry segments

| Segment and Size | Lagoon | Pump | Traveling Gun | Center Pivot |
|---|---|---|---|---|
| **Beef** | | | | |
| 1,000 | X | | X | |
| 5,000 | X | | | X |
| 10,000 | X | | | X |
| 20,000 | X | | | X |
| **Swine** | | | | |
| 2,500 | X | | X | |
| **Dairy** | | | | |
| 700 (Southwest & West) | X | | X | |
| 1,000 | X | | X | |
| 700 (South) | X | | X | |
| 1,000 | X | | X | |
| **Turkeys** | | | | |
| 55,000 | X | | X | |
| 100,000 | X | | X | |

Table 8. Investment costs for effluent control by segment.

| | | Lagoon Investment 1/ | Collection System 2/ | Disposal Equipment 3/ | Total Cost | Percent of Base Investment 4/ |
|---|---|---|---|---|---|---|
| | | | | | | (%) |
| Fed Cattle | 1,000 | $2,160 | $1,520 | $7,410 | $11,090 | 14 |
| | 5,000 | 8,800 | 6,320 | 15,600 | 30,720 | 10 |
| | 10,000 | 16,960 | 12,320 | 23,200 | 52,480 | 9 |
| | 20,000 | 32,680 | 24,320 | 37,600 | 94,600 | 9 |
| Hogs | 2,500 | 1,500 | 1,070 | 7,580 | 10,150 | 5 |
| Dairying | 700 | 3,170 | 1,110 | 8,340 | 12,620 | 2 |
| (Southwest & West) | 1,000 | 4,170 | 1,450 | 9,060 | 14,680 | 2 |
| Dairying | 700 | 6,680 | 1,895 | 11,880 | 20,455 | 4 |
| (South) | 1,000 | 9,560 | 2,570 | 14,080 | 26,210 | 3 |
| Turkeys | 55,000 | 2,090 | 1,315 | 8,040 | 11,445 | 4 |
| | 100,000 | 3,810 | 2,390 | 14,620 | 20,820 | 4 |

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1/ Includes fencing.

2/ Includes clean water diversion, run-off collection and settling basin.

3/ Liquid waste disposal only. Units were assumed to have equipment for solid waste disposal.

4/ Effluent control investment original cost divided by base investment replacement value of fixed assets only.

Table 9. Incremental costs for operating effluent control by segment.

| | | O & M | | Depreciation | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lagoons | Equipment | Lagoons | Equipment | Collection | Interest | Total Costs | Percent of Base Costs (%) |
| **Fed Cattle** | $ 1,000 | $ 108 | $ 741 | $ 108 | $1,482 | $ 76 | $ 416 | $ 2,931 | <1 |
| | 5,000 | 440 | 1,560 | 440 | 3,120 | 316 | 1,152 | 7,028 | <1 |
| | 10,000 | 848 | 2,320 | 848 | 4,640 | 616 | 1,968 | 11,240 | <1 |
| | 20,000 | 1,634 | 3,760 | 1,634 | 7,520 | 1,216 | 3,548 | 19,272 | <1 |
| **Hogs** | 2,500 | 75 | 758 | 75 | 1,516 | 54 | 381 | 2,859 | 1.4 |
| **Dairying** | 700 | 159 | 834 | 159 | 1,668 | 56 | 473 | 3,349 | <1 |
| **(Southwest & West)** | 1,000 | 209 | 906 | 209 | 1,812 | 73 | 551 | 3,760 | <1 |
| **Dairying** | 700 | 334 | 1,188 | 334 | 2,376 | 95 | 767 | 5,094 | <1 |
| **(South)** | 1,000 | 478 | 1,408 | 478 | 2,816 | 129 | 983 | 6,292 | |
| **Turkeys** | 55,000 | 105 | 804 | 105 | 1,608 | 66 | 429 | 3,117 | <1 |
| | 100,000 | 191 | 1,462 | 191 | 2,924 | 120 | 781 | 5,669 | <1 |

# VI. IMPACT ANALYSIS

Impacts were analyzed for four of the eight feedlots industry segments:

Fed cattle
Hogs
Dairying
Turkeys

The other segments were eliminated from further study because large-scale broiler and egg production facilities already meet "no discharge" standards, and data are not available to analyze the sheep and duck segments.

## A. Price Effects

Table 10 shows the price increases which would be required to maintain industry profitability. These estimates were derived from the net present value analysis described in Chapter IV. The required increases range from 0.2 to 1.38 percent of 1971 prices and are relatively minor.

The production effects of pollution controls on large scale producers must be considered in analyzing price effects. In initial places, a few smaller large-scale producers might drop out because of pollution control, but larger enterprises would absorb much of the decrease in output. Thus, there will likely be a small and temporary decrease in output in all impacted segments which will result in some upward price adjustments over the long run of a magnitude large enough to cover pollution abatement costs.

In the long-run, the relatively minor cost increases from pollution controls for large-scale producers will result in higher prices of about 1 to 1.5 percent.

## B. Financial Effects

Tables 11 and 12 show the financial effects of pollution controls. Table 11 presents after-tax cash proceeds and net present values before and after pollution controls. Table 12 compares after-tax incomes, cash flows, and returns on investment before and after controls.

Table 10. Required price increase to maintain industry profitability with effluent controls

| Segment | Size | Price Increase | |
|---|---|---|---|
| | (Head) | $/cwt. | (%) |
| Fed cattle | 1,000 | 0.155 | 0.48 |
| | 5,000 | 0.07 | 0.22 |
| | 10,000 | 0.065 | 0.20 |
| | 20,000 | 0.06 | 0.18 |
| Hogs | 2,500 | 0.28 | 1.38 |
| Dairying | 700 | 0.03 | 0.48 |
| (Southwest and West) | 1,000 | 0.027 | 0.44 |
| Dairying | 700 | 0.05 | 0.80 |
| (South) | 1,000 | 0.047 | 0.76 |
| Turkeys | 55,000 | 0.17 | 0.74 |
| | 100,000 | 0.16 | 0.71 |

Table 11. · Estimated cash proceeds and net present values of model feedlots without and with effluent controls

| | | Base | | With P.C. | |
|---|---|---|---|---|---|
| Segment | Size | Cash flow [1] | NPV | Cash flow [1] | NPV |
| | | ($000) | | ($000) | |
| Fed cattle | 1,000 | 17 | 50 | 16 | 37 |
| | 5,000 | 64 | 153 | 65 | 133 |
| | 10,000 | 145 | 444 | 146 | 408 |
| | 20,000 | 312 | 1,067 | 314 | 1,003 |
| Hogs | 2,500 | 28 | 96 | 28 | 84 |
| Dairying (Southwest & West) | 700 | 39 | 125 | 39 | 111 |
| | 1,000 | 64 | 250 | 64 | 233 |
| Dairying | 700 | 39 | 125 | 39 | 101 |
| | 1,000 | 64 | 250 | 64 | 221 |
| Turkeys | 55,000 | 26 | 49 | 26 | 36 |
| | 100,000 | 48 | 91 | 48 | 69 |

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[1] Cash flow derived by excluding interest from after-tax income computation. Will differ from cash flow reported in Table VI- 3.

Table 12. Comparison of after-tax return on investment and cash flow before and after pollution control

| Segments | Size | After-tax profit | | | After-tax ROI | | | Cash flow | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | % change | Pre | Post | % change | Pre | Post | % change |
| | | $000 | | | | | | | | |
| **Fed cattle** | 1,000 | 14 | 11 | -27 | 10 | 7 | -30 | 16 | 15 | -6 |
| | 5,000 | 54 | 51 | - 6 | 9 | 8 | -11 | 63 | 64 | +2 |
| | 10,000 | 126 | 120 | - 5 | 10 | 9 | -10 | 143 | 143 | 0 |
| | 20,000 | 275 | 265 | - 4 | 11 | <11 | <0 | 306 | 306 | 0 |
| **Hogs** | 2,500 | 15 | 12 | -20 | 11 | 8 | -27 | 24 | 23 | -4 |
| **Dairying** (Southwest & West) | 700 | 25 | 23 | - 8 | 5 | <5 | <0 | 30 | 30 | 0 |
| | 1,000 | 47 | 45 | - 4 | 7 | <7 | <0 | 53 | 53 | 0 |
| **Dairying** (South) | 700 | 25 | 22 | -12 | 5 | <5 | <0 | 31 | 30 | -3 |
| | 1,000 | 47 | 44 | - 6 | 7 | 6 | -14 | 53 | 53 | 0 |
| Turkeys | 55 | 7 | 3 | -57 | 4 | 2 | -50 | 22 | 20 | -9 |
| | 100 | 13 | 8 | -38 | 4 | 2 | -50 | 40 | 39 | -3 |

Substantially all net present values will remain positive after the imposition of controls, with the 1,000-head model cattle feedlot and both turkey model feedlots experiencing substantial declines.

Returns on investment are most seriously impacted for the small commercial cattle feeder, the hog model and the two turkey producers. Cash flows are not seriously affected for any of the models.

### C. Production Effects

Net present value analysis per se indicated that no large-scale producers will close; however, if feedlots do not have land available for ponds and for waste disposal, they may be forced to close. The precise number falling into this category is not known, but it is believed to be negligible.

Assuming that a few producers are impacted negatively by controls, some adjustments in output will occur over time. The number of large producers will probably increase to offset the loss of output from closures of smaller commercial producers.

### D. Other Effects

With minimal closures of large-scale feedlots, only slight employment or community effects are expected. The slight price increase should not be a significant factor in foreign trade.

## VII. LIMITS OF THE ANALYSIS

### A. General Accuracy

The analysis of the feedlots industry was based on published secondary data plus industry sources. Financial data had to be synthesized for each segment from available information to develop model plant budgets. Varying technologies, management systems and geographic considerations were recognized, but time and budget constraints precluded the development of model plants to reflect all of these differences. Vertical integration is another critical variable not incorporated into the analysis.

Accuracy is further limited by the assumptions concerning controls for small producers and the pollution control technologies to be employed. Alternate control technologies were outside the scope of this study but could significantly affect the conclusions.

Within these limitations, the results of this study are believed to be reliable for assessing the impact of pollution controls on large-scale operators.

## B. Range of Variations

The range of variations for cost and profitability data is ± 10 percent. A discount rate of 6.5 percent was used to reflect cost of capital. This probably varies ± 65 percent. Price changes to maintain profitability vary by ± 5 percent for each one percent interval in the discount rate.

## C. Critical Assumptions

Many assumptions were used throughout the analysis which are critical to conclusions. Some of the major ones are as follows:

1. The model feedlots are representative of operations in each segment.
2. Pro forma statements assume that 1971 cost-price relationships are the same as those which existed in the 1960's and will remain constant.
3. Small operators would not meet BPT and BAT Standards by 1977 and 1983.

## D. Questions Remaining

More precise data on numbers of producers, age of facilities, land availability, ducks and sheep production, opportunity costs for land utilization and future governmental policies are required to permit a more complete analysis.

# I. INDUSTRY SEGMENTS

## A. Types of Enterprises

### 1. Size and Number

Cattle feeders are divided into two types: the farmer and the commercial feeder. Farmer feeders operate feedlots with a capacity of less than 1,000 head. Commercial feeders have feedlots with a capacity of 1,000 head or more. In 1972, 152,429 farmer feeders were in operation representing 98.64 percent of the total number of feedlots and accounting for 38.4 percent of all fed cattle marketed. The 2,107 commercial feedlots existing in 1972 amounted to 1.3[illegible] percent of the total number of feedlots and produced 61.6 percent of all fed cattle marketed.

The trend in the cattle feeding industry has been to produce an increased number of fed cattle on a smaller number of feedlots (see Table I-1). Since 1962, the number of farmer feeders has declined from 229,365 to 152,429, a decrease of 76,936 lots or 34 percent. Meanwhile, the number of commercial feeders has increased from 1,439 to 2,107, an increase of 668 lots or 46 percent. The share of total fed cattle marketed by commerical feeders has increased from 36.4 percent to 61.6 percent over this ten-year span.

Commercial feedlots range in size from a capacity of 1,000 head to more than 32,000. Table I-2 shows that commercial feedlots of all sizes have increased in number. The largest commercial feeders (those with capacities greater than 16,000 head) have shown the largest percentage increase, both in their numbers share of fed cattle marketed. Those with 16,000 to 31,999 head capacity increased in number by 525 percent and from 4.4 percent to 15.6 percent of total fed cattle marketed from 1962 to 1972; those with capacities of 32,000 and over increased in number from a mere three to 59 and from 1.4 percent to 16.0 percent of total fed cattle marketed.

The hog industry in 1972 consisted of 810,400 producers ranging in size from less than ten head to several thousand head. As shown in Table I-1, the share of total production coming from hog operations with a capacity of 1,000 head and over increased between 1964 and 1969, but hog operations of less than 1,000 head capacity still accounted for 93 percent of all hogs. The larger producers increased from 0.1 percent of production units (farms) and 3.2 percent of total hogs on hand in 1964 to 0.4 percent of units and 6.8 percent of hogs in 1969.

Published data showing further detail on hog operations with capacities of 1,000 head and more are not available. The rather limited information suggests that there may be as few as 250 hog operations with a capacity of 2,500 head or greater, accounting for less than 0.1 percent of hogs on hand.

Table I-1. Number of feedlots and share of national production by size of feedlot capacity for industry segments

| Segment | No. of head | No. of units | Percent of total | No. of head | Percent of total | No. of units | Percent of total | No. of head | Percent of total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (000) | | | | | |
| | | | 1972 | | | | 1962 | | |
| Fed cattle 1/ | <1,000 | 152,429 | 98.6 | 10,275 | 38.3 | 229,365 | 99.4 | 9,271 | 63.7 |
| | 1,000 up | 2,107 | 1.4 | 16,560 | 61.7 | 1,439 | 0.6 | 5,289 | 36.3 |
| Total | | 154,536 | 100.0 | 26,835 | 100.0 | 230,804 | 100.0 | 14,560 | 100.0 |
| | | | 1969 2/ | | | | 1964 2/ | | |
| Hogs | <1,000 | 529,849 | 99.5 | 51,692 | 93.2 | 1,079,239 | 99.9 | 52,345 | 98.6 |
| | 1,000 up | 2,443 | 0.5 | 3,763 | 6.8 | 1,132 | 0.1 | 1,735 | 3.2 |
| Total | | 532,292 | 100.0 | 55,455 | 100.0 | 1,080,371 | 100.0 | 54,080 | 100.0 |
| Dairying | <200 | 565,751 | 99.6 | 10,228 7/ | 91.5 | 1,131,730 | 99.8 | 13,841 | 94.7 |
| | 200 up | 2,486 | 0.4 | 947 | 8.5 | 2,192 | 0.2 | 782 | 5.3 |
| Total | | 568,237 | 100.0 | 11,175 | 100.0 | 1,133,912 | 100.0 | 14,623 | 100.0 |
| Sheep | <1,000 | 112,982 | 91.2 | n.a. | 44.3 | 230,328 | 98.1 | n.a. | 52.2 |
| | 1,000 up | 3,690 | 3.0 | n.a. | 50.5 | 4,691 | 1.9 | n.a. | 47.8 |
| | Other 3/ | 7,186 | 5.8 | n.a. | 5.2 | | | | |
| Total | | 123,858 | 100.0 | | 100.0 | 235,019 | 100.0 | | 100.0 |
| Chicken:layers | <20,000 | 276,771 | 98.9 | n.a. | 52.3 | 1,143,499 | 99.9 | n.a. | 74.9 |
| | 20,000 up | 3,128 | 1.1 | n.a. | 47.7 | 1,948 | 0.1 | n.a. | 25.1 |
| Total | | 279,899 | 100.0 | | 100.0 | 1,145,447 | 100.0 | | 100.0 |
| Chicken:Broilers | <20,000 4/ | 26,054 | 77.3 | 1,004,351 | 41.3 | 30,728 | 87.5 | 1,086,833 | 56.7 |
| | 20,000 up | 7,634 | 22.7 | 1,424,501 | 58.7 | 4,400 | 12.5 | 82,541 | 43.3 |
| Total | | 33,688 | 100.0 | 2,428,852 | 100.0 | 35,128 | 100.0 | 1,915,374 | 100.0 |
| Turkeys | <50,000 5/ | 5,285 | 97.4 | 70,839 | 58.6 | | | | |
| | 50,000 up | 140 | 2.6 | 32,516 | 31.4 | | | | |
| Total | | 5,425 | 100.0 | 103,455 | 100.0 | | | | |
| Ducks | Small 6/ | 4,858 | 97.1 | 2,270 | 16.0 | | | | |
| | Large | 147 | 2.9 | 11,911 | 84.0 | | | | |
| Total | | 5,005 | 100.0 | 14,181 | 100.0 | | | | |

Footnotes for Table I-1.

[1] Data for the 23 principal cattle producing states from Cattle on Feed, U.S.D.A., S.R.S.. Number of feedlots with 1,000 or more capacity is number of lots operating anytime during the year. Number under 1,000 head capacity is number at end of year.

[2] Data for all but feeder cattle segments are for 1969 and 1964: i.e., Census of Agriculture, 1969 (farms with gross sales of $2,500 or more) and Census of Agriculture, 1964 (all farms). Data for hogs and for dairy represent numbers on hand. For all other segments, number of head refers to marketings.

[3] Farms having feeder lambs only. Size data are not available.

[4] Figures are for farms with annual sales of less than 100,000 birds. With an assumed production cycle of five times per year, this implies a capacity of less than 20,000.

[5] Annual sales of less than 100,000 based on production cycle of twice per year.

[6] Average annual sales of 467 for small and 81,027 for large units.

[7] Milk production in millions of pounds.

Table I-2. Large feedlots - number of feedlots and share of production, by size of feedlot capacity, for industry segments

| Segment | No. of head | No. of units | Percent of total | No. of head | Percent of total | No. of units | Percent of total | No. of head | Percent of total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (000) | | | | (000) | |
| | | 1972 | | | | 1962 | | | |
| Fed cattle 1/ | 1,000-3,999 | 1,396 | 0.90 | 2,636 | 9.8 | 1,131 | 0.49 | 1,660 | 11.4 |
| | 4,000-7,999 | 311 | 0.20 | 2,181 | 8.1 | 184 | 0.08 | 1,116 | 7.7 |
| | 8,000-15,999 | 216 | 0.14 | 3,254 | 12.1 | 101 | 0.04 | 1,681 | 11.5 |
| | 16,000-31,999 | 125 | 0.08 | 4,191 | 15.6 | 20 | 0.01 | 636 | 4.4 |
| | 32,000 | 59 | 0.04 | 4,298 | 16.0 | 3 | -- | 196 | 1.4 |
| | Total | 2,107 | 1.4 | 26,835 | 61.6 | 1,439 | 0.6 | 5,289 | 36.4 |
| | | 1969 2/ | | | | | | | |
| Sheep | 1,000-2,499 | 2,458 | 2.0 | n.a. | 17.6 | 3,052 | 1.3 | n.a. | 17.9 |
| | 2,500-4,999 | 806 | 0.7 | n.a. | 13.5 | 939 | 0.4 | n.a. | 12.1 |
| | 5,000 | 426 | 0.3 | n.a. | 19.4 | 470 | 0.2 | n.a. | 17.8 |
| | Total | 3,690 | 3.0 | | 50.5 | 4,691 | 1.9 | | 47.8 |
| Chicken:Layers | 20,000-49,999 | 2,238 | 0.8 | n.a. | 22.1 | 1,484 | 0.1 | n.a. | 12.7 |
| | 50,000-99,999 | 565 | 0.2 | n.a. | 11.2 | 329 | -- | n.a. | 5.7 |
| | 100,000 | 325 | 0.1 | n.a. | 14.4 | 135 | -- | n.a. | 6.7 |
| | Total | 3,128 | 1.1 | | 47.7 | 1,948 | 0.1 | | 25.1 |

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1/ Data for the 23 principal cattle producing states from Cattle on Feed, USDA, SRS.

2/ Data for sheep and eggs for 1969 and 1964 are from Census of Agriculture, 1969 (farms with gross sales of $2,500 or more) and Census of Agriculture, 1964 (all farms).

Dairy producers maintain herds ranging in size from one to over 700 head. Between 1964 and 1969 the number of farm dairy herds decreased considerably from 1,133,912 to only 568,237, the combined result of a decrease in the number of small herds by 50 percent, from 1,131,730 to 565,751, and a 13 percent increase in the number of dairy herds over 200 head from 2,192 to 2,486. During this period, the number of dairy cows accounted for by herds of 200 head and over increased from 5.3 to 8.5 percent of total dairy cows.

Sheep and lamb operations in 1964 numbered 116,672 of which 3,690 had at least 1,000 head. The number of producers of this size decreased by 1,001 from 1964 to 1969, a decrease of 21 percent and the number of production units with less than 1,000 head decreased by an even larger percent. Large producers increased from 1.9 percent of total farms with sheep and lambs to 3.2 percent, and increased their share of total sheep and lambs sold from 47.8 percent to 53.1 percent. In addition, 7,186 farms reported having only lambs on feed. The size distribution of these operations is not known.

For the large producers, the percentage decrease in the number of production units ranked from largest for units of 1,000-2,499 head capacity (about 19 percent) to smallest for the units of 5,000 head and over capacity (about 9 percent). Correspondingly, increases in the share of total sheep sales ranked from largest for the largest producers to smallest for the 1,000-2,499 head capacity units (see Table I-2).

The chicken layer industry in 1969 consisted of 279,899 producers whose flocks ranged up to at least 100,000 birds and over. The trend to larger production units was particularly striking in this segment of the feedlot industry.

The production units operating in 1969 represent only 24 percent of the 1964, 1,145,447 units. The number of producers with flocks of 20,000 birds and larger increased from 0.1 percent of production units in 1964 to 1.1 percent in 1969. During that time, the large producers increased their share of total layers from 25.1 percent to 47.7 percent (see Table I-1).

Large producers of all size categories have increased substantially in number and percent of total layers. For example, those with 100,000 layers or more increased in number by 140 percent, from 135 to 325 and increased their share of total layers from 6.7 percent to 14.4 percent (see Table I-2).

(It should be noted that while many egg producers raise their own replacement birds for their layer flocks, others purchase them from specialized pullet-growing farms. In 1969, over 132 million pullets of 3 months or older were sold from 5,763 farms (not all of these specialize in producing pullets only). The 1,369 farms selling 30,000 pullets and over accounted for 66.9 percent of the total. Production of pullets by these farms are not reflected in subsequent discussions and data.)

Broiler chicken production was accounted for almost entirely by large production units both in 1964 and in 1969. However, some increase in concentration occurred during that period. The largest producers, those with annual sales of 100,000 birds or more (a 20,000 bird capacity for five cycles per year production) increased in number from 4,400 or 12.5 percent of production units in 1964 to 7,634 or 22.7 percent in 1969. Correspondingly, their sales increased from 43.3 percent to 58.7 percent of total industry sales (see Tables I-1 and I-2).

The turkey industry is a highly concentrated industry, with 5,425 producers selling an average of about 20,000 birds each in 1969. As has been the case in most industry segments, a relatively small number of large producers account for a relatively large percent of total production. A mere 147 producers (2.9 percent of production units) with a capacity of 50,000 birds and over (100,000 and greater annual sales, based on two production cycles per year) provided nearly one-third of the industry output. Although comparable detailed data are not available for 1964, industry information indicates an increase in concentration. In 1964, producers of 5,000 birds and over (10.8 percent of all production units) provided 94.5 percent of sales; in 1969, they accounted for about 98 percent of sales. 1/

Duck production was reported by 5,005 farms in 1969 and most production was accounted for by relatively few farms. Of 14,180,751 birds produced for sale by the industry, 11,911,000 were supplied by 147 producers in the five leading duck producing states, for an average of 81,027 birds per farm. The remaining 2,269,751 birds were produced by 4,858 relatively small production units, an average of 467 birds per farm.

## 2. Technology, Efficiency and Age

Recent technological improvements have increased efficiency for the fed beef industry. For example, bulk feed, nutritionally formulated, is now handled by an automated system. The feed is ground at the feedlot's mill and distributed to the feed bunks via conveyors and augers. The automated process has decreased the man-hours required per head of beef while the nutritional feed formulation has resulted in less feed consumption per pound of gain.

The degree to which a feedlot utilizes technological improvements depends in part on the size of the operation, for a considerable fixed investment is required to implement the technology. A fairly large operation is required if a reduction in total cost per pound of gain is to be realized. The production efficiency of commercial beef feedlots of different sizes is reflected in the cost data presented in Chapter 2. Of course, this data may reflect mainly differences in technologies feasible for different size operations, rather than differences in management skills.

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1/ Census of Agriculture, 1969.

Because the technological advances described are fairly recent and best suited to large scale feedlot operations and, too, because (as shown in Table I-2) the number of larger lots (capacity 16,000 and over) has proportionally increased, it is concluded that the larger commercial feedlots are relatively new. The more moderate sized commercial lots will tend to have facilities associated with older technologies. The average age of production facilities is assumed to range from 10 years for the larger lots to 15 years for the smaller commercial feedlots. Table I-3 provides data on the years in which feedlots of various sizes were established in Texas and Oklahoma and gives some support to these estimates.

The hog industry employs a variety of technologies and enterprise configurations. Large-scale feeders tend toward capital intensive systems which involve a great degree of animal confinement. Permanent buildings in which hogs are confined for breeding, farrowing, and feeding operations use a variety of labor-saving equipment to achieve better management control of breeding, disease, and feed intake. For instance, their multiple and continuous farrowing systems (e.g., four farrowing per year as compared with only two for small hog producers) results in a more intensive use of the facilities.

Hog operation efficiency for all sizes has increased in recent years and the data suggest that such efficiency depends mainly on managerial capability. The total cost per hog produced is about the same for large operations using capital intensive technologies as for equally well-managed, small operations not using such technologies. The value of confinement systems and automated feed and waste handling systems is that they increase the production that good management may realize.

Very little information about the age of hog production facilities is available. However, on the assumption that the age of facilities is inversely related to the number of production units of that size (because firms entering the industry or significantly increasing their scale of operations will generally add new facilities), the better than doubling of the number of large hog producers between 1964 and 1969 implies that their facilities are, on the average, relatively new, about 10 years.

Milk production per cow is a good measure of overall productivity and of the level of technology in the dairy industry. Based on this criterion, data indicate that technology has progressed in recent years. Production per cow has increased from 7,029 pounds in 1960 to 10,271 pounds in 1972.

| Year | Milk Production per Cow - U.S. (pounds) |
|---|---|
| 1960 | 7,029 |
| 1965 | 8,305 |
| 1970 | 9,747 |
| 1972 | 10,271 |

## Table I-3. Year in which present type of cattle feeding operations were established, by size of feedlot, Texas and Oklahoma, 1966-1967

| State and year | Less than 1,000-head capacity | 1,000 to 1,999-head capacity | 2,000 to 4,999-head capacity | 5,000 to 9,999-head capacity | 10,000-head-and-more capacity | Total |
|---|---|---|---|---|---|---|
| Texas: | | | | | | |
| | | | Percent | | | |
| Before 1945 | 8.8 | 0 | 5.9 | 0 | 5.0 | 7.5 |
| 1945-49 | 11.8 | 0 | 0 | 11.8 | 10.0 | 9.9 |
| 1950-54 | 5.9 | 0 | 0 | 11.7 | 5.0 | 5.2 |
| 1955-59 | 20.6 | 40.0 | 32.3 | 29.4 | 15.0 | 23.1 |
| 1960-64 | 44.1 | 46.7 | 50.0 | 29.4 | 45.0 | 44.4 |
| After 1964 | 8.8 | 13.3 | 11.8 | 17.7 | 20.0 | 9.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Oklahoma: | | | | | | |
| Before 1945 | 7.7 | 14.3 | 12.5 | 0 | 0 | 8.0 |
| 1945-49 | 30.7 | 0 | 0 | 0 | 0 | 28.5 |
| 1950-54 | 15.4 | 14.3 | 12.5 | 50.0 | 25.0 | 15.4 |
| 1955-59 | 15.4 | 14.3 | 25.0 | 0 | 0 | 15.6 |
| 1960-64 | 23.1 | 28.5 | 50.0 | 50.0 | 50.0 | 24.3 |
| After 1964 | 7.7 | 28.6 | 0 | 0 | 25.0 | 8.2 |
| Total | 100.0 | 10.00 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Dietrich, Raymond A., "The Texas-Oklahoma Cattle Feeding Industry," Texas Agr. Exp. Sta., Bul. 1079, Dec., 1968.

The increase in productivity has been a result of better breeding, improved feeding, and better management. For example, an increasing number of cattle are "challenged fed," that is, they are fed increased amounts of concentrates to challenge their genetic ability to produce milk. As was the case in the cattle and hog segments, these newest technologies require substantial investments in equipment and more highly skilled management. For these reasons, large operations are best suited to employing these techniques and obtaining increased productivity. (Supportive, indirect evidence of this is the fact that those states ranking highest in average number of cows per farm also rank highest in milk production per cow.)

Of course, not all producers have made use of improved production techniques. For example, the difference in production per cow between California and Mississippi is 7,023 pounds. Only a small part of this variation can be attributed to differences in climatic conditions.

If the age of production facilities is related to changes in the number of production units of a given size, the approximate 12 percent increase in the number of large dairy operations between 1964 and 1969 implies that facilities are somewhat newer for large producers than the industry average age. The large dairy operations generally use either open-lot or free-stall systems. Table I-4 indicates that facilities for both systems are generally newer than those for the most common system, stanchion barns. The average age of production facilities for large dairy operations is estimated to be 12 years.

Sheep technology is relatively unsophisticated. In sheep operations of at least 1,000 head, breeding stock and lambs are generally kept on open range, grazing on grasses unsuitable for other livestock and receiving supplemental feedings only as required by weather and pasture conditions. Data on lamb feedlot operations are not available; however, lamb operations, though similar to large cattle feedlots, are probably less sophisticated. Industry personnel describe the typical feedlot as one with shelter sheds, self feeders, and waterers. Limited use is made of available technology for roughage handling, bunk-line feeding, ration feeding, and manure disposal.

No direct data on the age of sheep production facilities are available. Since open range feeding requires relatively limited technology, little in the way of new investment has occurred in these operations. Lamb feedlots are, also, characterized by limited investment in modern facilities. Since both the number of large producers and their production has declined, it is unlikely that many new production facilities have been constructed in recent years. Exceptions exist, of course, but new enterprises are decidedly in the minority; therefore, production facilities are assumed to be relatively old, averaging perhaps 16-18 years.

Table I-4. Types of facilities used by dairymen, 1970

| Management System | Percent Farms | Percent Built Since 1960 |
|---|---|---|
| Stanchion Barns | 66 | 8 |
| Open lot | | |
| - loose housing | 21 | 23 |
| - free stall | 15 | 28 |
| Free Stall | | |
| - cold covered | 13 | 49 |
| - warm covered | 2 | 34 |

Source: Estimated, private source.

The commercial egg industry is highly competitive and innovative, characteristics resulting in the rapid adoption of new technology, particularly by the larger producers. As indicated previously, an increasing proportion of total egg production has been accounted for by these larger, more efficient firms. (Table I-1)

Layer handling techniques have changed drastically during the last five years. Data from trade sources, for instance, show a shift from traditional floor-litter systems to cage or wire-type systems; indeed, 75 percent of all layers in 1972 were housed in cages or wire-type houses compared to only 44 percent in 1965. Cage system use has increased most rapidly in the growth areas. The use of improved technologies has resulted in increased flock sizes, decreased mortality, and decreased labor requirement. Similarly, per hen production and egg quality have increased. These changes indicate the creased efficiency of the new technology.

Poultry houses are designed to minimize labor in feeding, cleaning, as well as egg collection. Houses are also designed for specific climatic conditions. Data on the age of houses and other facilities are unavailable; however, some inferences can be drawn from the exit from the industry of small producers and the increased number and capacity of the larger production units. With the average life of a layer house estimated to be 20 years, the average age of production facilities of the larger production units is estimated at 5-10 years.

As will be detailed in section I-B, (p. 37), a shift in the location of production has occurred. The average age of large producer facilities in the declining production regions (New York, Pennsylvania, and the Corn Belt States) is estimated at 10-12 years; in the increasing production regions (Maine, California, Mid-South and South Atlantic states), it may average 5-8 years.

Broiler chicken production in the United States has experienced rapid increases in efficiency through improved technology. Better housing, automation in feeding and watering, preventative disease management, improved rations, and rapid bird growth have all resulted in reducing production costs. A recent report by the U.S.D.A. characterized gains in broiler production:

> "The greater-than-50-percent reduction in price and cost from 1949 to 1969 was possible because of substantial increases in production efficiency. Primary breeders have improved broiler strains sufficiently to reduce the time needed to produce a 3.5-pound live bird from 12-14 weeks 20 years ago to 8-9 weeks now. Poultry nutritionists have developed improved feed formulations which have helped reduce the amount of feed needed to produce 1 pound of live broiler from 4 pounds in 1940 to 2.2 pounds today.

> Mortality rates of 10 to 20 percent were common 20 years ago, while a rate of more than 6 percent is considered high today. Man-hours per 1,000 broilers produced declined from 250 in 1940 to 15 in 1969 as a result of increased mechanization, more efficient layouts, and larger flock sizes. Recent improvements in modern poultry housing have stressed complete environmental control; that is, control of light, temperature, humidity, and air movement. Although further gains in efficiency are possible, it is difficult to see how they can be of the magnitude of those in the past 20 years."

Increased efficiencies can be accomplished in broiler production with emphasis today being placed on housing, handling and feeding of birds. At present, most broilers are grown in confined housing of 20,000 to 50,000 square feet of space. Birds roam throughout this space, manure is deposited on litters which may or may not be removed after each batch, and the birds are subjected to changes in temperature.

As has been the case in the other industry segments studied, new technology has been more common among the large and expanding producers.

Based on the moderate shift of production to the larger units that occurred between 1964 and 1969, the average age of broiler housing and facilities is estimated to be about 10 years. There has been some geographical shift of production, suggesting that facilities in the growth regions (Arkansas, Virginia, Alabama, Mississippi, North Carolina, and Texas) may be somewhat newer, but the shift has not been as pronounced as in the case of egg production. (See Section I-B.)

Turkey growing technology has not changed greatly during the past decade. When contrasted with that of the broiler industry, efficiency in turkey production is judged to be far behind. This relative inefficiency is evident in feed conversion rates, mortality rates, and the percent of birds achieving Grade A. Further evidence is the wide variance from industry norms of individual producer efficiency levels; in broiler production, they are clustered near industry averages.

In the turkey production process, day old poults are started in (heated, if needed) brooder houses on floors having excretion collection litters. At about 8 weeks of age, the poults are either placed on open range or in semi-confined or totally confined systems. Industry personnel estimate that 70 percent are grown on open range, 25 percent in semi-confined, and 5 percent in totally confined systems. The type of system used will vary mainly by geographic location. In Minnesota, semi and total confinement systems represent the principal management system. In California most birds are grown in semi-confinement. In Missouri and much of the South and Southwest, most birds are grown on range.

While all three types of production systems are used by large producers, the use of semi-confinement and fully confined production units is increasing. Semi-confinement systems provide about two square feet of space per bird in addition to range. Houses provide shelter at night and during inclement weather. At other times, poults are free on open ranges. Full-confinement systems require about four square feet of space per bird, and they are confined from the time of hatching to processing.

Both types of confinement systems require greater investment than do open range systems. As the production of poults becomes less seasonal, industry personnel anticipate an increased use of semi-and-full-confinement houses.

The age of production facilities was estimated by considering the life expectancy of the facilities and by analyzing the growth in production and in the adoption of new technology. Because both of these latter factors have been moderate, the average age of semi-confinement facilities (brooder and pole sheds) is put at 10 years, about one-half of their average life expectancy.

Average duck sales per production unit are large, averaging 150,000 birds each. To produce this volume of birds on individual units probably necessitates the use of available current technology for feeding rations, handling of feed, preventing diseases, etc. Most duck producers employ a wet-lot technology whose open ponds provide swimming and watering. However, birds are also produced on dry lots and in semi-confined systems, and both limit water use to watering functions.

### 3. Integration and Diversification

The total production process for livestock, poultry, and dairy products includes seven stages: (1) feed grain production, (2) feed milling, (3) production stock breeding, (4) feeder animal production, (5) feeding, (6) processing, and (7) wholesale and retail distribution. The feedlots industry is defined as the fifth stage in this process. However, more than one of these stages is frequently combined within one enterprise. This section describes the extent to which the above stages are combined, i.e., the extent of vertical integration engaged in by the larger feedlot operators.

Feedlot operators may also utilize diverse operation. Many are diversified into less-directly related types of enterprises, most commonly the production of grain for direct marketing and the production of more than one animal species. This section, then, also comments on the extent to which the larger feedlot operators are diversified.

Special arrangements concerning stages 5, 6 and 7 of the above process are dealt with to some extent in Chapter III, which deals with pricing.

Commercial cattle feedlots are highly specialized operations ranging in capacity from 1,000 to over 100,000 head. They may be single enterprise operations, or they may be combined with other farm-sector enterprises. Many producers are diversified into grain production for direct marketing and into the production of other livestock and poultry; some are vertically integrated into feed grain production, feed manufacturing, feeder-cattle production, and/or meat packing. Integration is encouraged by the typically large investment required for commercial feedlots in specialized capital such as feed mills, pens, and feed bunks. Although some of the data is rather old, Tables I-5 through I-7 give some indication of the extent of integration in this industry segment.

Ownership of commercial feedlots ranges from sole-proprietorships to corporate farms and includes cooperatives. The feedlot operation may own the cattle being fed or it may custom feed cattle owned by others.

The latter, the custom feeders, essentially perform the service of feeding cattle for a fee, in most cases without taking ownership of the cattle. Custom feeding in 1964 accounted for approximately 45 percent of all cattle in commercial feedlots with capacities between 5,000 and 50,000. Feedlots with over 50,000 head capacity do less custom feeding with only an estimated 23.1 percent of their capacity fed under fee arrangements. (See Table I-5.) Such custom feeding arrangements follow many patterns. The following are typical.

The cattle on feedlots that custom feed are owned by a variety of groups. The data for feedlots of at least 1,000 head, in 1964, showed that cattle feeders accounted for 45 percent, farmers and ranchers owned 28 percent, meat packers owned 18 percent, and the remaining 11 percent were accounted for by livestock marketing agencies, non-farm agricultural businesses, and food retailers (see Table I-6).

Packer-owned cattle are fed either in packer-owned feedlots or in custom feedlots. In 1965, the 206 packers that were feeding owned about 7 percent of all fed cattle marketed, and packer-associated interests accounted for an additional 4 percent (see Table I-7). In 1971, 122 packers owned 4.5 percent of fed cattle marketings.

Retail food chains have occasionally engaged in cattle feeding and slaughter operations, but they account for only relatively few cattle marketings. In 1964, three major food chains accounted for most of the 719,000 head slaughtered by retail food chains. They fed only 64,000 head--less than half a percent of fed cattle marketings in a 39 state region. Of all custom fed cattle in commercial feedlots in 1965, 0.6 percent were owned by retail food chains. While pertinent data are not available, it is felt that though ownership and feeding of cattle by food chains has increased since 1965, it still constitutes a relatively minor percent of total fed cattle production.

Cooperative feedlots numbered only seven as of January 1, 1969, with a total capacity of about 50,000 head.

## Table I-5. Percentage of cattle numbers marketed, by types of feeding arrangement, by capacity groups, sample data for 15 states, 1964[1]

| Capacity group | Owned by feedlot | Custom fed | Other arrange-ments [2] | Unknown | Total |
|---|---|---|---|---|---|
| | Percent | | | | |
| Commercial feeders: | | | | | |
| 1,000-1,999 | 85.9 | 12.3 | .4 | 1.4 | 100.0 |
| 2,000-4,999 | 74.9 | 21.0 | 1.9 | 2.2 | 100.0 |
| 5,000-9,999 | 55.7 | 40.2 | 3.1 | 1.0 | 100.0 |
| 10,000-14,999 | 48.9 | 48.8 | .3 | 2.0 | 100.0 |
| 15,000-19,999 | 50.0 | 44.3 | 5.7 | --- | 100.0 |
| 20,000-29,999 | 49.8 | 44.5 | 1.1 | 4.6 | 100.0 |
| 30,000-49,999 | 47.1 | 41.3 | 11.6 | --- | 100.0 |
| 50,000 and over | 48.5 | 23.1 | 28.4 | --- | 100.0 |

[1] The 15 States are Iowa, Nebr., Kans., Okla., Tex., Colo., Mont., Idaho, Wyo., Utah, N. Mex., Ariz., Calif., Oreg., and Wash.

[2] Consists primarily of partnership arrangements.

Source: National Commission on Food Marketings, "Organization and Competition in the Livestock and Meat Industry," Tech. Study No. 1, June, 1966.

## Table I-6. Percentage of cattle fed on custom basis, by principal occupations of owners, feedlots of 1,000 or more head capacity, 15 states, 1964 1/

| Principal occupation of owner of cattle on feedlots with custom-fed cattle operations | Percentage custom-fed in feedlots 1,000 or more head |
|---|---|
| | (Percent) |
| Farmer or rancher | 27.8 |
| Cattle feeder | 45.4 |
| Nonfarm agricultural business | 1.5 |
| Meatpackers and packer-buyers | 17.9 |
| Other livestock marketing agencies | 4.6 |
| Food retailers | .6 |
| Others 2/ | 2.2 |
| TOTAL | 100.0 |

1/ For States, see Table I-5.

2/ Includes lending agencies, nonagricultural business firms, professional workers, and investors.

Source: National Commission on Food Marketing, Organization and Competition in the Livestock and Meat Industry, Tech. Study No. 1, June 1966.

Table I-7. Number of packers feeding cattle and number of head fed compared with total fed marketings of cattle in 39 states, 1954-1971.

| Year | Number of packers feeding | Number of cattle fed by packers 1/ | Fed cattle marketings in 39 states 2/ | Packer feeding as percent of fed marketings |
|---|---|---|---|---|
| | | 1,000 hd. | 1,000 hd. | Percent |
| 1954 | 165 | 564.9 | 9,482 | 6.0 |
| 1955 | 161 | 545.8 | 10,762 | 5.1 |
| 1956 | 157 | 520.8 | 11,331 | 4.6 |
| 1957 | 151 | 557.6 | 11,285 | 4.9 |
| 1958 | 176 | 729.1 | 11,787 | 6.2 |
| 1959 | 157 | 617.0 | 12,843 | 4.8 |
| 1960 | 165 | 856.7 | 13,621 | 6.3 |
| 1961 3/ | 206 | 919.2 [1,215.2] | 14,561 | 6.3 [8.8] |
| 1962 | 215 | 981.4 | 15,434 | 6.4 |
| 1963 | 211 | 1,175.6 | 16,808 | 7.0 |
| 1964 | 190 | 1,126.8 | 18,319 | 6.2 |
| 1965 3/ | 204 | 1,291.4 [2,059.2] | 18,936 | 6.8 [11.5] |
| 1966 | 202 | 1,473.7 | 20,597 | 7.2 |
| 1967 | 198 | 1,547.8 | 21,920 | 7.1 |
| 1968 | 174 | 1,397.3 | 23,286 | 6.0 |
| 1969 | 154 | 1,632.8 | 24,930 | 6.6 |
| 1970 | 140 | 1,454.5 | 25,830 | 5.6 |
| 1971 | 122 | 1,173.6 | 26,312 | 4.5 |

1/ The number of cattle (including calves) fed by meat packers was summarized from annual reports of packers filed with the Packers and Stockyards Administration, USDA. Feeding by packer-associated interests is not included. Most packer feeding is reported on a fiscal year basis.

2/ Economic Research Service, USDA, "Livestock and Meat Situation," May, 1967 and October, 1965 issues and "Livestock and Meat Statistics." Estimates for 39 states are on a calendar year basis and account for most fed cattle (and calf) marketings in the United States.

3/ Numbers and percentages enclosed by brackets include feeding by packer-associated interests. Data are not available for other years.

Source: Packers and Stockyards Administration, "Packers and Stockyards Resume," Vol. X, No. 13, U.S.D.A., Dec. 1972.

Large, hog feeding operations, those with capacities of at least 1,000 head are highly specialized enterprises. While the owner of such an operation may have other interests, diversification in direct conjunction with the hog operation is not common and, in any case, the hog operation will generally be the primary farm enterpise. On the other hand, some degree of vertical integration will often be found in connection with large hog operations. Most operations produce animals from farrow to finish (i.e., market). Some finish all pigs farrowed and buy additional feeders. Others feed most farrows to finish but sell some as feeders. Table I-8 summarizes the enterprise combinations practiced; the data refer to hog producers of all sizes. Feed milling is also commonly practiced by large producers. The extent of integration at the marketing end is reflected in Chapter III.

Although dairy enterprises of at least 700 head are generally specialized, some diversification into other activities such as grain and livestock production is found. Vertical integration, also, occurs in the dairy industry. Some producers grow and mill part of their feed, and some have integrated forward by establishing processing units and distribution outlets. Some processors have integrated backwards, also, by establishing their own herds. The volume of milk produced by integrated operations is a very small percent of total milk production.

Sheep production is generally a part of a diversified farm or ranch as either the primary or the secondary enterprise of a large ranch operation. They graze well on terrain too rough, high, or arid for other domesticated animals and on plants unacceptable to other animals. Feeder and slaughter lamb operations are found in combination with wool production. Shearing usually takes place just before the ewes begin lambing.

Integration in sheep production results essentially from large producers breeding and feeding their own lambs, primarily on open range. Depending on range conditions, from one-third to two-thirds of the lambs are sold directly off the range as "fat lambs" ready for slaughter. Some are fed briefly on harvested fields to add marketing weight and the remainder are sold as feeder lambs and are fed to slaughter weight, which takes relatively little time, in feedlots. Forward integration is limited. The Packers and Stockyards Resume of December 15, 1972, reported that 9.7 percent of all lambs slaughtered were fed by or under contract for meat packers. Apparently all other lambs are fed by independent producers and sold on the free market.

Large egg producers are highly specialized operations involving a full-time commitment. With the exception of Midwest operations, most egg producers have few alternatives to their egg enterprise. Land bases are relatively small, preventing diversification into other livestock production requiring larger acreage, and the topography of the land often limits row crop production.

Table I-8. Inventories and marketings of hogs by management system (1972)

| Type of Management System | Percent | | | | |
|---|---|---|---|---|---|
| | Farmers | Sows on hand | Market Hogs Sold | Feeder Pigs Sold | Feeder Pigs Marketed |
| Farrow-to-finish<br>(Finish all pigs farrowed, buy no feeder pigs) | 45.6 | 57.5 | 59.7 | 2.8 | 0.0 |
| Feeder pig producer<br>(Finish no pigs, sell feeders only) | 11.1 | 12.0 | 0.0 | 53.7 | 0.0 |
| Market hogs only<br>(Farrow no pigs, buy all feeders) | 15.5 | 0.0 | 18.0 | 0.1 | 77.8 |
| Farrow-finish-purchase<br>(Finish some pigs farrowed, and buys feeder pigs too) | 9.3 | 9.7 | 13.3 | 0.9 | 21.6 |
| Farrow-finish-feeder pig producer<br>(Finish some pigs farrowed, sells feeder pigs too) | 14.6 | 16.8 | 6.6 | 41.3 | 0.4 |
| Purebred breeder<br>(Primarily sells breeding stock-either sells or finishes those left) | 3.9 | 4.1 | 2.4 | 1.2 | 0.2 |

Source: Unpublished data. Private sources.

The concentration of egg production among large producers has been accompanied by the industry's increased vertical integration both forward and backward, with producers establishing their own feed milling facilities, hatcheries, breeding flocks, egg processing facilities, and distribution programs. The following data indicate the extent of industry vertical integration as well as the increase in integration that has developed.

| | Percent of Market Eggs Produced By: | | | |
|---|---|---|---|---|
| | Owner Integrator | Contract Producer | Contract Marketing | Independent Producers |
| 1955 | 1.5 | 0.5 | 12.5 | 85.5 |
| 1970 | 20.0 | 20.0 | 15.0 | 45.0 |

Integration by the larger producers, however, is surely more pronounced than indicated by these percentages.

With the exception of that in California, broiler production is concentrated in areas of limited farming alternatives. The topography of the land and its fertility are not conducive to intensive crop and/or livestock production. These areas are deficit in grain production and require imports of feed grains for the broiler industry. Once committed to broiler production by building housing, however, growers have few alternatives. With modifications, housing facilities could be used for other poultry such as layers or brooding turkey poults, but such facilities have limited possibilities for livestock production.

For producers with at least a 20,000 bird capacity, broiler production usually is the primary farm enterprise and for the largest producers, it is the sole enterprise. However, for some of the producers in the 20,000-40,000 bird capacity range, broiler operation is a part-time occupation used to supplement off-farm income or to more fully utilize family labor. Limited research on grower characteristics indicates that beef brood cows production is the best alternative for broiler growers since most growers have some acreage which can best be used for grazing cattle.

The broiler industry, particularly its largest producers, is highly integrated with 95 percent or more of all broilers produced under contract or by integrated firms. Under this system, broilers are produced and marketed under contract between the grower (farmer) and contractor (integrator) and each bears a specified part of the costs and risks in production. The contractor usually retains product ownership and the growers provide housing, equipment, litter, power and labor on a fee-per-gain pound basis. The contractor furnishes chicks, feed, medicines and field supervision. Figure I-1 depicts the functional relationships of an integrated operation.

Turkey operations with capacity of 30,000 birds or more are highly specialized farm enterprises. Not only is an operation of this size virtually a full-time commitment by the producer, but also, most turkey growing occurs in marginal farming areas. Diversification is limited and declining among large producers.

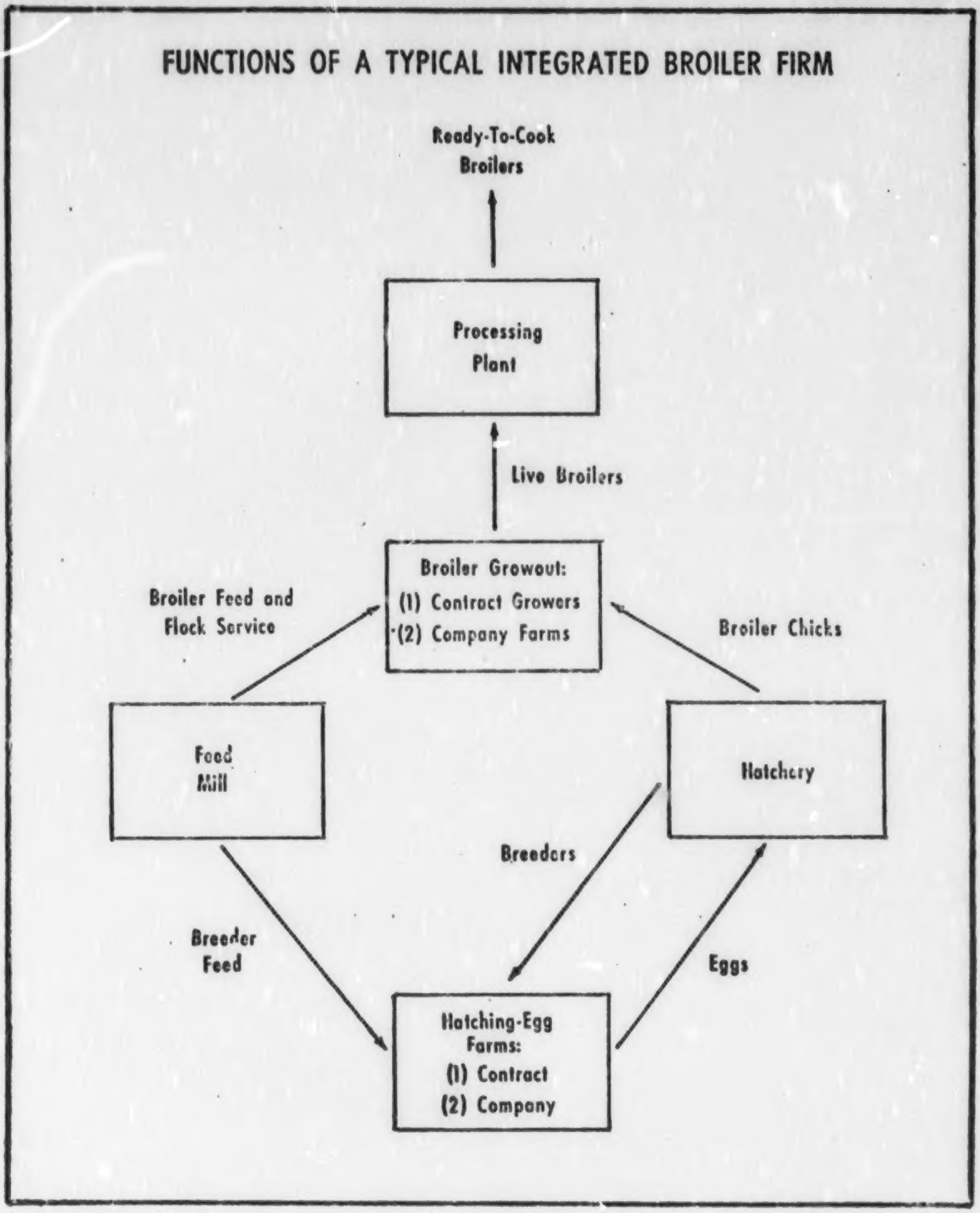
Integration is extensive in the turkey industry. Data on the actual ownership of production facilities by integrators (contractors) are not available, but an estimated 90 percent or more of all turkeys are presently grown under some type of contractual arrangement between grower and integrator. This serves as a reasonable estimate of the extent of such arrangements among large producers. Contractors typically are operators of processing and distribution units. Contractual arrangements vary and farmers must either have an arrangement with a processor to process his birds or do his own processing. The latter is not a common practice. Large producers also commonly engage in their own feed milling.

Little detailed information is readily available on duck production. Based on the scale of operations, large duck producers (over 30,000 capacity) are assumed to be engaged in highly integrated production and marketing arrangements. Individual producers maintain breeding flocks, hatch eggs, raise ducklings to market weight, and either process their own birds or have contractual production agreements with contractors who process and market the birds.

Feedstuffs Magazine (September 4, 1972) reported on a fully integrated operation located in Indiana. This firm produced 16 percent of U.S. production. The firm grew 300,000 ducklings on its own facilities and purchased the remainder under contracts from 20 growers located in adjacent areas. The contract grower furnished the facilities and labor. The contractor furnished ducks, feed, medication and supervision. The growers were compensated under three plans: per bird fee, or poundage fee, or a feed and mortality efficiency program fee.

Like large producers of other poultry, diversification among large producers apparently is limited.

Figure I-1


FUNCTIONS OF A TYPICAL INTEGRATED BROILER FIRM
Ready-To-Cook Broilers
Processing Plant
Live Broilers
Broiler Growout: (1) Contract Growers (2) Company Farms
Broiler Feed and Flock Service
Broiler Chicks
Feed Mill
Hatchery
Breeders
Breeder Feed
Eggs
Hatching-Egg Farms: (1) Contract (2) Company

Source: U. S. Department of Agriculture, Economic Research Service, The Chicken Broiler Industry: Structure, Practices, and Costs, Marketing Research Report No. 930, May, 1971.

## B. Location of Major Production Segments

The geographic distribution of U.S. feedlots is indicated in Table I-9 which summarizes the production and proportion of production among the ten leading states (five for ducks) for each industry segment.

Where data could be obtained, the figures for both 1964 and 1969 are provided to show trends.

Fed beef production is located predominately in two regions: the Corn Belt and adjacent states and the Southwest. Table I-10 shows the 23 leading states. The Corn Belt (Illinois, Iowa) and adjoining states (Minnesota, Nebraska, Kansas) have historically been the leaders in beef production. Together they had 60 percent of all feedlots and provided 48 percent of fed cattle marketings in 1972. With the exception that in Kansas, production in these states is accounted for predominately by farmer feeders and relatively small commercial feeders: only 10.8 percent of the cattle were fed on commercial lots and none were fed on large lots (those of 16,000 head capacity or greater).

The Southwest (Texas, Oklahoma, Arizona, Colorado, California) has developed more recently into a major beef producing area. These states accounted for only two percent of all cattle feedlots, but provided for 36 percent of fed cattle marketed. Production is dominated by the larger commercial feedlots for over 70 percent of the cattle produced in both Texas and Arizona are fed in large (over 16,000) commercial feedlots.

Table I-11 summarizes percentage changes in numbers of commercial feedlots of various size categories in the ten leading states from 1962-1972.

Hog production is concentrated in the Corn Belt and neighboring states where all ten of the leading hog producing states (see Table I-9) are found. Together they accounted for 76 percent of hog marketing in 1971. With Kansas and South Dakota being replaced by North Carolina and Kentucky, the same states were the leading states in 1969 in the number of farms with hogs, accounting for 67.2 percent of all farms.

As indicated in Table I-2, only 0.5 percent of all farms and only 6.8 percent of all hogs were accounted for by hog feedlots of 1,000 head capacity and greater. Table I-12 shows the number of large farms and their share of the state's production for the ten leading hog-producing states. Note that these figures represent total sales (versus capacity) of both feeder and market (slaughter) hogs.

In all states, less than three percent of farms marketed at least 1,000 head. Marketings of these producers exceed 10 percent of the state's marketings in six states, led by North Carolina with 29.5 percent.

Table I- 9. Feedlots industry production - leading states

| State | Cattle 1972 Head marketed (000's) | | | Hogs 1971 Number of hogs (000's) | | |
|---|---|---|---|---|---|---|
| | Head marketed (000's) | Percent of U.S. total | Rank | Number of hogs (000's) | Percent of U.S. total | Rank |
| Iowa | 3,986 | 14.8 | 3 | 22,624 | 22.9 | 1 |
| Illinois | 1,003 | 3.7 | 7 | 11,569 | 11.7 | 2 |
| Minnesota | 935 | 3.5 | 8 | 5,870 | 6.0 | 6 |
| Wisconsin | | | | 3,422 | 3.5 | 8 |
| Michigan | | | | | | |
| Ohio | | | | 4,118 | 4.2 | 7 |
| Indiana | | | | 7,124 | 7.2 | 4 |
| Missouri | | | | 7,609 | 7.7 | 3 |
| Kansas | 2,405 | 9.0 | 4 | 3,375 | 3.4 | 9 |
| Nebraska | 3,990 | 14.9 | 2 | 5,952 | 6.1 | 5 |
| South Dakota | | | | 3,296 | 3.3 | 10 |
| Colorado | 2,291 | 8.5 | 5 | | | |
| Texas | 4,308 | 16.1 | 1 | | | |
| Oklahoma | 626 | 2.3 | 10 | | | |
| Arizona | 899 | 3.3 | 9 | | | |
| California | 2,062 | 7.7 | 6 | | | |
| Totals | 22,505 | 83.8 | | 74,959 | 76.0 | |

Table I- 9. Feedlots industry production - leading states (continued)

| | Sheep 1971 | | Dairy 1972 | | |
|---|---|---|---|---|---|
| | Ewes on feed | Lambs on feed | Pounds of milk produced | Percent of U.S. total | Rank |
| | (000's) | | (millions) | | |
| Iowa | 10 | 3 | 4,330 | 3.6 | 8 |
| Illinois | | | | | |
| Minnesota | | 7 | 9,295 | 7.7 | 4 |
| Wisconsin | | | 19,079 | 15.9 | 1 |
| Michigan | | | 4,802 | 4.0 | 6 |
| Ohio | 10 | 8 | 4,405 | 3.7 | 7 |
| Indiana | | | | | |
| Missouri | | | | | |
| Kansas | | | 2,918 | 2.4 | 10 |
| Nebraska | | 4 | | | |
| South Dakota | 4 | 5 | | | |
| Colorado | 7 | 1 | | | |
| Texas | 1 | 2 | 3,300 | 2.8 | 9 |
| Oklahoma | | | | | |
| Arizona | | | | | |
| California | 3 | 10 | 10,327 | 8.6 | 2 |
| Maine | | | | | |
| New York | | | 9,985 | 8.3 | 3 |
| Pennsylvania | | | 6,880 | 5.7 | 5 |
| Mississippi | | | | | |
| Florida | | | | | |
| Georgia | | | | | |
| Alabama | | | | | |
| Arkansas | | | | | |
| Virginia | | | | | |
| Maryland | | | | | |
| North Carolina | | | | | |
| Delaware | | | | | |
| Idaho | 8 | 9 | | | |
| Montana | 6 | | | | |
| Wyoming | 2 | 6 | | | |
| Utah | 5 | | | | |
| New Mexico | 9 | | | | |
| Totals | 65 | | 75,321 | 62.7 | |

**Table I- 9. Feedlots industry production - leading states**

| | Layers 1972 | | | Broilers 1972 | | |
|---|---|---|---|---|---|---|
| | Number of layers | Percent of U.S. total | Rank | Broilers produced | Percent of U.S. total | Rank |
| | (000's) | | | (000's) | | |
| Iowa | | | | | | |
| Illinois | | | | | | |
| Minnesota | 10,917 | 3.6 | 10 | | | |
| Wisconsin | | | | | | |
| Michigan | | | | | | |
| Ohio | | | | | | |
| Indiana | 12,865 | 4.2 | 6 | | | |
| Missouri | | | | | | |
| Kansas | | | | | | |
| Nebraska | | | | | | |
| South Dakota | | | | | | |
| Colorado | | | | | | |
| Texas | 12,115 | 3.9 | 8 | 178,511 | 5.8 | 6 |
| Oklahoma | | | | | | |
| Arizona | | | | | | |
| California | 39,201 | 12.8 | 1 | | | |
| Maine | | | | 71,344 | 2.3 | 10 |
| New York | | | | | | |
| Pennsylvania | 15,081 | 4.9 | 5 | | | |
| Mississippi | | | | 256,264 | 8.3 | 5 |
| Florida | 12,075 | 3.9 | 9 | | | |
| Georgia | 24,754 | 8.1 | 2 | 442,937 | 14.4 | 2 |
| Alabama | 12,552 | 4.1 | 7 | 399,274 | 13.0 | 3 |
| Arkansas | 16,519 | 5.4 | 3 | 532,135 | 17.3 | 1 |
| Virginia | | | | 77,238 | 2.5 | 9 |
| Maryland | | | | 177,247 | 5.8 | 7 |
| North Carolina | 15,172 | 4.9 | 4 | 301,772 | 9.8 | 4 |
| Delaware | | | | 131,873 | 4.3 | 8 |
| Idaho | | | | | | |
| Montana | | | | | | |
| Wyoming | | | | | | |
| Utah | | | | | | |
| New Mexico | | | | | | |
| Totals | 171,251 | 55.8 | | 2,568,595 | 83.5 | |

Table I- 9. Feedlots industry production - leading states (continued)

| | Turkeys 1972 | | | Ducks 1969 | | |
|---|---|---|---|---|---|---|
| | Turkeys sold (000's) | Percent of U.S. total | Rank | Ducks sold (000's) | Percent of U.S. total | Rank |
| Iowa | 6,524 | 5.1 | 7 | | | |
| Illinois | | | | 633 | 4.5 | 5 |
| Minnesota | 20,880 | 16.2 | 1 | | | |
| Wisconsin | | | | 1,453 | 10.2 | 3 |
| Michigan | | | | | | |
| Ohio | 4,064 | 3.2 | 10 | | | |
| Indiana | 6,060 | 4.7 | 8 | 2,965 | 20.9 | 2 |
| Missouri | 10,000 | 7.8 | 4 | | | |
| Kansas | | | | | | |
| Nebraska | | | | | | |
| South Dakota | | | | | | |
| Colorado | | | | | | |
| Texas | 7,851 | 6.1 | 6 | | | |
| Oklahoma | | | | | | |
| Arizona | | | | | | |
| California | 17,636 | 13.7 | 2 | 766 | 5.4 | 4 |
| Maine | | | | | | |
| New York | | | | 6,096 | 43.0 | 1 |
| Pennsylvania | | | | | | |
| Mississippi | | | | | | |
| Florida | | | | | | |
| Georgia | | | | | | |
| Alabama | | | | | | |
| Arkansas | 8,165 | 6.3 | 5 | | | |
| Virginia | 5,519 | 4.3 | 9 | | | |
| Maryland | | | | | | |
| North Carolina | 12,035 | 9.3 | 3 | | | |
| Delaware | | | | | | |
| Idaho | | | | | | |
| Montana | | | | | | |
| Wyoming | | | | | | |
| Utah | | | | | | |
| New Mexico | | | | | | |
| Totals | 98,858 | 76.7 | | 11,913 | 84.0 | |

Table I-10. Number of feedlots of 1,000 head capacity and larger and fed cattle marketed by size of feedlot by states, 1972

| State | 1,000-1,999 |  | 2,000-7,999 |  | 8,000-15,999 |  | 16,000 and up |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  | No. feedlots | No. head sold | No. feedlots | No. head sold | No. feedlots | No. head sold | No. feedlots | No. head sold | Total feedlots | Total sold |
|  |  | (000) |  | (000) |  | (000) |  | (000) |  | (000) |
| 1. Texas | 53 | 57 | 77 | 420 | 38 | 558 | 62 | 3,175 | 230 | 4,299 |
| 2. Nebraska | 305 | 505 | 206 | 1,020 | 20 | 345 | 12 | 505 | 543 | 2,375 |
| 3. Colorado | 67 | 118 | 85 | 462 | 23 | 439 | 16 | 1,089 | 191 | 2,108 |
| 4. California | 42 | 23 | 96 | 274 | 43 | 526 | 33 | 1,231 | 214 | 2,054 |
| 5. Kansas | 36 | 52 | 43 | 296 | 31 | 580 | 21 | 988 | 131 | 1,916 |
| 6. Arizona | 5 | 5 | 15 | 61 | 8 | 120 | 18 | 711 | 46 | 897 |
| 7. Oklahoma | 8 | 12 | 16 | 127 | 11 | 145 | 6 | 295 | 41 | 579 |
| 8. Iowa | 89 | 140 | 75 | 245 | 6 | 65 | -- | -- | 90 | 430 |
| 9. Idaho | 34 | 40 | 41 | 120 | 13 */ | 231 */ | -- | -- | 88 | 391 |
| 10. New Mexico | 6 | 7 | 19 | 81 | 12 | 158 | 6 | 123 | 43 | 369 |
| 11. Washington | 9 */ | 31 */ | 8 | 53 | 4 | 65 | 4 | 181 | 25 | 330 |
| 12. Montana | 36 | 31 | 31 | 119 | 5 */ | 71 */ | -- | -- | 72 | 221 |
| 13. Oregon | 13 | 12 | 14 | 44 | 3 */ | 62 */ | -- | -- | 30 | 118 |
| 14. Illinois | 49 | 65 | 11 */ | 52 */ | -- | -- | -- | -- | 60 | 117 |
| 15. South Dakota | 39 | 31 | 12 | 31 | 3 | 45 | -- | -- | 54 | 107 |
| 16. Indiana | 19 | 37 | 5 */ | 33 */ | -- | -- | -- | -- | 24 | 70 |
| 17. Ohio | 28 */ | 62 */ | -- | -- | -- | -- | -- | -- | 28 | 62 |
| 18. Minnesota | 29 | 37 | 6 | 15 | -- | -- | -- | -- | 35 | 52 |
| 19. Michigan | 16 | 24 | 9 | 27 | -- | -- | -- | -- | 25 | 51 |
| 20. Missouri | 15 | 20 | 11 */ | 28 */ | -- | -- | -- | -- | 26 | 48 |
| 21. Wisconsin | 13 */ | 26 */ | -- | -- | -- | -- | -- | -- | 13 | 26 |
| 22. North Dakota | 14 | 13 | 4 */ | 12 */ | -- | -- | -- | -- | 18 | 25 |
| 23. Pennsylvania | 3 */ | 9 */ | -- | -- | -- | -- | -- | -- | 3 | 9 |
| Total 23 states | 865 | 1,138 | 751 | 3,098 | 218 | 3,170 | 206 | 8,957 | 2,040 | 16,654 |
| Percent of total | 42 | 7 | 37 | 19 | 11 | 19 | 10 | 55 | 100 | 100 |

*/ Lots and marketing from larger size groups are combined to avoid disclosing individual operations.

Source: Cattle on Feed, Crop Reporting Board, SRS, USDA (January 1974).

Table I-11. Percentage change in number of commercial feedlots, by size, 1962 to 1972, for the ten leading states.

| State | Percentage Change | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1,000-1,999 | 2,000-3,999 | 4,000-7,999 | 8,000-15,999 | 16,000-39,999 | 32,000 and over | Total |
| Texas | -45.9 | -36.7 | 25.8 | 71.4 | (38) | (24) | -15.1 |
| Nebraska | 50.9 | 86.7 | 75.0 | 81.8 | (8) | (4) | -29.3 |
| Iowa | 169.7 | 1766.7 | (19) | (6) | | | -28.0 |
| Kansas | 50.0 | 112.5 | 116.7 | 244.4 | (16) | (5) | -50.0 |
| Colorado | 116.1 | 157.8 | 125.0 | 64.3 | (11) | (5) | -36.6 |
| California | -60.4 | -49.0 | 9.7 | 16.2 | 76.9 | 233.3 | -49.1 |
| Illinois | 133.3 | (6) | 66.7 | - | | | -48.4 |
| Minnesota | 70.6 | 50.0 | - | - | | | -41.6 |
| Arizona | -83.3 | -72.0 | -61.9 | -27.2 | (9) | (9) | -72.0 |
| Oklahoma | -38.4 | -0.1 | 16.7 | (11) | | | -77.0 |

Source: Cattle on Feed, U.S.D.A., S.R.S.

Parenthesis denote an increase from zero to the number of feedlots in the parenthesis.

Table I-12. Number of farms selling market hogs or feeders and percent of hog marketings, 1,000 hogs or greater, ten leading states.

| States | Number of Farms | Percent of Farms | Percent of Marketings |
|---|---|---|---|
| Iowa | 1,453 | 1.8 | 8.8 |
| Illinois | 1,299 | 2.8 | 17.8 |
| Indiana | 804 | 2.4 | 18.3 |
| Missouri | 491 | 1.2 | 11.6 |
| Ohio | 333 | 1.3 | 11.9 |
| North Carolina | 270 | 1.4 | 29.5 |
| Minnesota | 269 | 0.7 | 6.4 |
| Nebraska | 244 | 0.8 | 6.3 |
| Kentucky | 156 | 0.8 | 13.9 |
| Wisconsin | 116 | 0.5 | 6.1 |

Source: Census of Agriculture.

Wisconsin is the nation's leading dairy producing state, accounting for 15.9 percent of total milk production in 1972 (Table I-9). Four of the other leading states are in that part of the country - Michigan, Minnesota, Iowa and Ohio. Other leading states range from New York and Pennsylvania in the northeast to Texas and California in the southwest. Together with Kansas, these states accounted for 62.7 of total milk production in 1972.

As Table I-13 indicates, dairy producers with 100 cows or more accounted for 16.9 percent of all dairy cows in 1969. The percentage for the individual states varies greatly. In Table I-13 the range is from 2.3 percent in Iowa and 2.6 in Wisconsin to 43.9 in Texas and 87.1 percent in California. Texas, California and New York accounted for nearly 37 percent of all large dairy producers - and large producers made up 38.9 percent of all production units in California, 5.6 percent in Texas, and 3.4 percent in New York. In the other leading states, less than 2 percent of all producers were large and they had fewer than 10 percent of their states' dairy cows.

The major concentration of ewes are found in the western half of the United States where 80 percent of the breeding stock and eight of the ten leading states were located in 1971. Texas, the leading state, reported 2,530,000 ewes on farms, 20 percent of all breeding stock. Table I-9 indicates the ranking of the ten leading states.

Lamb feeding is distributed differently than is breeding stock. Colorado led in the number on feed in 1972 with 16.2 percent of lambs. The leading ten states are ranked in Table I-9; together they accounted for 68 percent of all lambs fed (Table I-14).

Of the ten leading states in the number of units reporting sheep, all but Iowa (with 16.1 percent) show that more than fifty percent of their sheep production was accounted for by large producers (1,000 head or more). Approximately three-fourths of the sales came from big producers in Colorado, Wyoming, California, Idaho, and Utah (Table I-15). Wyoming, California and Texas reported the largest number of very large producers (5,000 head and over) (Figure I-2).

Egg production is distributed widely over the United States with the ten leading states accounting for only 55.8 percent of the total layers in 1972. Some concentration is observable in the Southern and Southeastern states: Georgia, Florida, Alabama, North Carolina, Arkansas, and Texas account for 30.3 percent of all layers.

As indicated earlier (Table I-9) less than half (47.7 percent) of layers are found on large production units (20,000 layers and greater). Only Florida and California show a markedly heavier concentration of production from large producers with 82.2 and 86.2 percent respectively (Table I-16) and California has the highest percentage of its production from the very large units (100,000 layers and greater) -- 49.8 percent.

Table I-13. Number of farms with 100 or more dairy cows, percent of farms, percent of cows, ten leading states.

| State | Number of Farms | Percent of Farms | Percent of Cows |
|---|---|---|---|
| Wisconsin | 322 | 0.5 | 2.6 |
| Minnesota | 98 | 0.3 | 1.4 |
| New York | 742 | 3.4 | 11.4 |
| California | 2,104 | 38.9 | 87.1 |
| Pennsylvania | 297 | 1.4 | 6.3 |
| Iowa | 82 | 0.3 | 2.3 |
| Ohio | 184 | 1.0 | 5.7 |
| Michigan | 263 | 1.9 | 8.8 |
| Texas | 781 | 5.6 | 43.9 |
| Kentucky | 109 | 0.6 | 5.3 |

Table I-14. Sheep and lambs on feed, number by states, percent of production, ranked by states, U.S. 1972

| State | Number on Feed[1] |  | Percent of U.S. - 1972 |
|---|---|---|---|
|  | 1962 | 1972 |  |
|  | (thousands) |  |  |
| Colorado | 570 | 440 | 16.2 |
| Texas | 240 | 399 | 14.7 |
| Iowa | 474 | 179 | 6.6 |
| Nebraska | 377 | 152 | 5.6 |
| South Dakota | 257 | 145 | 5.3 |
| Wyoming | 105 | 116 | 4.3 |
| Minnesota | 248 | 109 | 4.0 |
| Ohio | 198 | 108 | 4.0 |
| Idaho | 95 | 102 | 3.8 |
| California | 302 | 102 | 3.8 |
| Montana | 98 | 100 | 3.6 |
| Oregon | 64 | 99 | 3.6 |
| Kansas | 314 | 97 | 3.6 |
| Arizona | 76 | 91 | 3.4 |
| Utah | 82 | 85 | 3.1 |
| North Dakota | 113 | 73 | 2.7 |
| Illinois | 163 | 55 | 2.0 |
| Michigan | 84 | 46 | 1.7 |
| Missouri | 116 | 44 | 1.6 |
| Oklahoma | 53 | 33 | 1.2 |
| New Mexico | 52 | 32 | 1.2 |
| Nevada | 8 | 28 | 1.0 |
| Washington | 30 | 25 | 0.9 |
| Indiana | 60 | 21 | 0.8 |
| Wisconsin | 50 | 21 | 0.8 |
| New York | 21 | 13 | 0.5 |
| Total U.S. | 4,250 | 2,715 | 100.0 |

Source: Agricultural Statistics, U.S.D.A., 1972

[1] January 1.

Table I-15. 1969 large producer sheep and lamb sales in ten leading states by percent of all farms and all sales per date

| | Inventories of Sheep and Lambs | | | |
|---|---|---|---|---|
| | 1,000-2,499 | 2,500-4,999 | 5,000+ | Total |
| **Texas** | | | | |
| No. Farms | 716 | 210 | 66 | 992 |
| Percent Farms | 7.1 | 2.1 | .7 | 9.9% |
| Percent Sold | 23.7 | 20.9 | 14.8 | 59.4% |
| **Colorado** | | | | |
| No. Farms | 255 | 74 | 32 | 361 |
| Percent Farms | 12.0 | 3.5 | 1.5 | 17.0% |
| Percent Sold | 26.6 | 17.9 | 34.6 | 79.1% |
| **Wyoming** | | | | |
| No. Farms | 258 | 105 | 87 | 450 |
| Percent Farms | 12.3 | 5.0 | 4.2 | 21.5% |
| Percent Sold | 22.6 | 18.2 | 34.6 | 75.4% |
| **California** | | | | |
| No. Farms | 177 | 91 | 77 | 345 |
| Percent Farms | 7.7 | 4.0 | 3.3 | 15.0% |
| Percent Sold | 16.6 | 18.1 | 44.2 | 78.9% |
| **South Dakota** | | | | |
| No. Farms | 129 | 29 | 6 | 164 |
| Percent Farms | 1.9 | .4 | .1 | 18.8% |
| Percent Sold | 14.1 | 10.9 | 9.5 | 53.3% |
| **Idaho** | | | | |
| No. Farms | 107 | 60 | 36 | 203 |
| Percent Farms | 6.5 | 3.6 | 2.2 | 12.3% |
| Percent Sold | 19.1 | 23.0 | 32.3 | 74.4% |
| **Iowa** | | | | |
| No. Farms | 33 | 5 | 2 | 40 |
| Percent Farms | .2 | .1 | .1 | 0.4% |
| Percent Sold | 10.5 | 2.5 | 3.1 | 16.1% |
| **Montana** | | | | |
| No. Farms | 217 | 56 | 13 | 286 |
| Percent Farms | 8.6 | 2.2 | .6 | 11.4% |
| Percent Sold | 29.1 | 15.6 | 7.7 | 52.4% |

(cont'd)

Table I-15. (Continued)

| | Inventories of Sheep and Lambs | | | |
|---|---|---|---|---|
| | 1,000-2,499 | 2,500-4,999 | 5,000+ | Total |
| **Utah** | | | | |
| No. Farms | 160 | 76 | 25 | 261 |
| Percent Farms | 9.3 | 4.3 | 1.4 | 15.0% |
| Percent Sold | 28.4 | 24.4 | 21.3 | 74.1% |
| **Oregon** | | | | |
| No. Farms | 39 | 11 | 11 | 61 |
| Percent Farms | 1.6 | .5 | .5 | 2.6% |
| Percent Sold | 8.4 | 4.3 | 47.3 | 60.0% |

Source: 1969 Census of Agriculture

Table I-16. Number of farms and percent of layers, by size for farms with 20,000 layers and greater, ten leading states, 1969.

| | 20,000-49,999 | 50,000-99,999 | 100,000+ | Total |
|---|---|---|---|---|
| **California** | | | | |
| No. farms | 282 | 103 | 81 | 466 |
| Percent farms | 10.0 | 3.7 | 2.9 | 16.6% |
| Percent layers | 20.5 | 15.9 | 49.8 | 86.2% |
| **Georgia** | | | | |
| No. farms | 267 | 60 | 31 | 358 |
| Percent farms | 6.0 | 1.9 | .8 | 8.7% |
| Percent layers | 28.1 | 13.4 | 16.4 | 57.9% |
| **Arkansas** | | | | |
| No. farms | 143 | 34 | 16 | 193 |
| Percent farms | 3.7 | .9 | .4 | 5.0% |
| Percent layers | 22.0 | 11.4 | 29.3 | 62.7% |
| **North Carolina** | | | | |
| No. farms | 127 | 24 | 8 | 159 |
| Percent farms | 1.4 | .3 | .1 | 1.8% |
| Percent layers | 23.9 | 9.6 | 8.7 | 42.2% |
| **Pennsylvania** | | | | |
| No. farms | 94 | 17 | 7 | 118 |
| Percent farms | 1.2 | .2 | .1 | 1.5% |
| Percent layers | 19.7 | 6.4 | 9.9 | 36.0% |

(cont'd)

Table I-16. (Continued)

| | 20,000-<br>49,999 | 50,000-<br>99,999 | 100,000+ | Total |
|---|---|---|---|---|
| **Indiana** | | | | |
| No. farms | 118 | 18 | 6 | 142 |
| Percent farms | 1.5 | .2 | .1 | 1.8% |
| Percent layers | 27.0 | 9.1 | 7.5 | 43.6% |
| **Alabama** | | | | |
| No. farms | 106 | 32 | 11 | 149 |
| Percent farms | 2.8 | .8 | .2 | 3.8% |
| Percent layers | 21.8 | 14.9 | 9.5 | 46.2% |
| **Texas** | | | | |
| No. farms | 118 | 30 | 17 | 165 |
| Percent farms | .8 | .2 | .1 | 1.1% |
| Percent layers | 26.8 | 16.1 | 20.8 | 63.7% |
| **Florida** | | | | |
| No. farms | 154 | 38 | 22 | 214 |
| Percent farms | 10.1 | 2.5 | 1.4 | 14.0% |
| Percent layers | 33.5 | 17.4 | 31.3 | 82.2% |
| **Minnesota** | | | | |
| No. farms | 20 | 6 | 7 | 33 |
| Percent farms | .1 | .1 | .1 | .3% |
| Percent layers | 4.9 | 2.9 | 9.7 | 17.5% |

Source: 1969 Agricultural Census: Farms with gross sales of 2,500 or more.

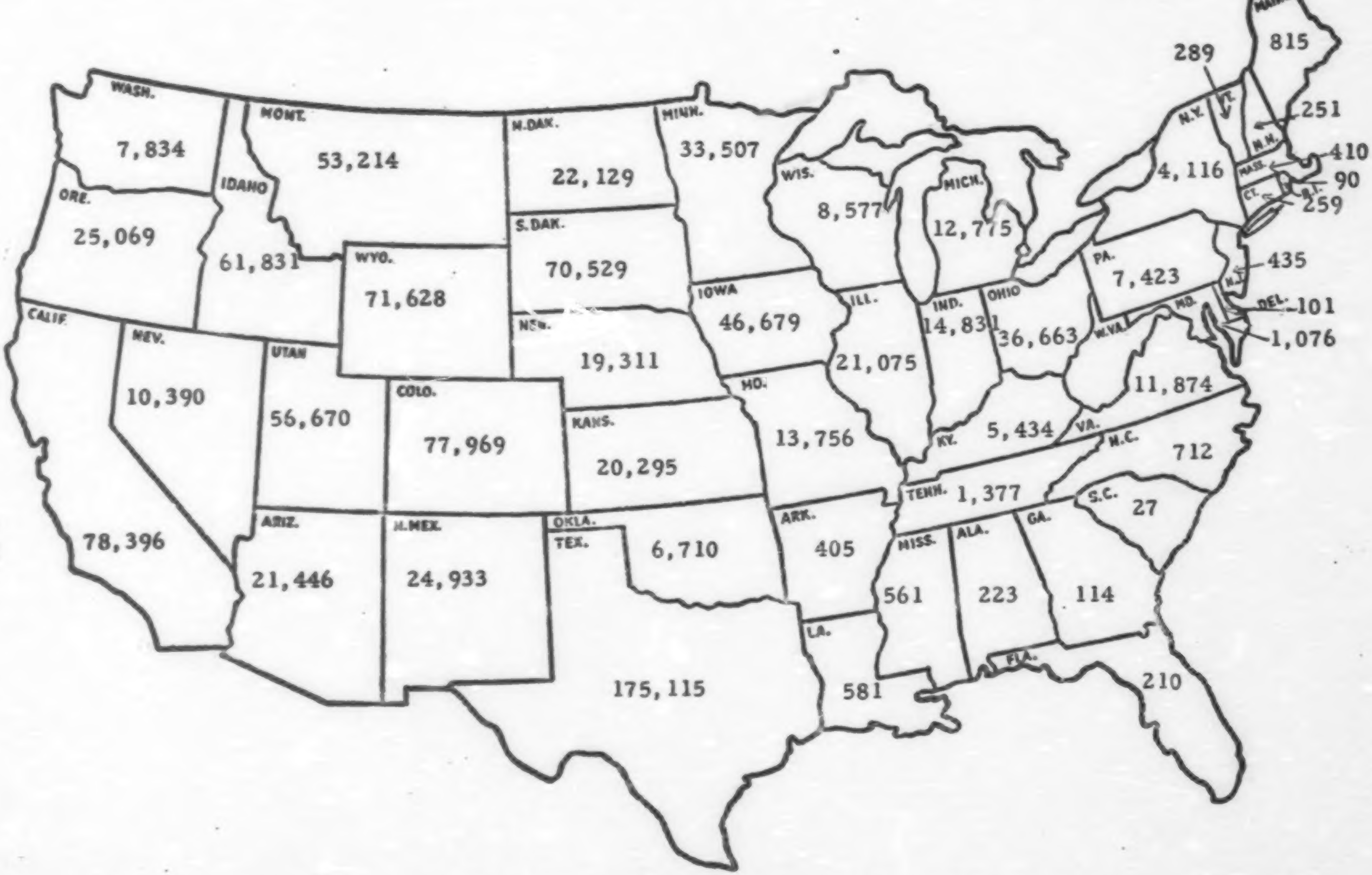

WASH.
7,834
ORE.
25,069
CALIF.
78,396
IDAHO
61,831
NEV.
10,390
MONT.
53,214
WYO.
71,628
UTAH
56,670
ARIZ.
21,446
COLO.
77,969
N.MEX.
24,933
N.DAK.
22,129
S.DAK.
70,529
NEB.
19,311
KANS.
20,295
OKLA.
6,710
TEX.
175,115
MINN.
33,507
IOWA
46,679
MO.
13,756
ARK.
405
LA.
581
WIS.
8,577
ILL.
21,075
MICH.
12,775
IND.
14,831
OHIO
36,663
KY.
5,434
TENN.
1,377
MISS.
561
ALA.
223
GA.
114
FLA.
210
S.C.
27
N.C.
712
VA.
11,874
W.VA.
PA.
7,423
MD.
1,076
DEL.
101
N.J.
435
N.Y.
4,116
VT.
289
N.H.
251
MAINE
815
MASS.
410
R.I.
90
CT.
259

**Figure I-2.** Quantity of sheep and lambs produced in pounds, liveweight basis, 1,000 pounds, 1971
Source: Agricultural Statistics, USDA, 1972.

Egg production has shifted geographically during the past seven years with production becoming more concentrated in the South, California, Maine and Indiana. Major increases in layer numbers, since 1965, have occurred in Florida, Arkansas, Georgia, Maine, the Carolina's, Alabama, California and Indiana. Declines occurred in other leading states such as Iowa, Wisconsin, Illinois, Minnesota, Ohio, Texas, New York, Michigan, and Pennsylvania. Major egg producing states which had increases in layer numbers since 1965 are as follows:

| State | Percent of increase in layer number, 1965-1972 |
|---|---|
| Florida | 57 |
| Arkansas | 49 |
| Georgia | 32 |
| Maine | 31 |
| South Carolina | 27 |
| North Carolina | 22 |
| Alabama | 20 |
| California | 20 |
| Indiana | 13 |
| Mississippi | 4 |
| Missouri | 2 |

Major broiler production areas are located in the northwestern corner of Arkansas, northern Georgia and Alabama, Central Mississippi, east Texas, southern Maine, the Delmarva Peninsula of Maryland, Delaware and Virginia, central North Carolina and California. These areas account for a majority of all production; other areas have but limited production.

The ten leading broiler producing states produce eighty-four percent of all broilers grown in the United States. The three leading states of Arkansas, Georgia and Alabama alone produce forty-five percent of all broilers. Of the ten leading states, all but Maine, Delaware and Maryland are located in the South or South Central area.

Industry growth since 1965 has been uneven in the major producing areas. States in which production has increased more rapidly than the national average of thirty-two percent are Arkansas, Virginia, Alabama and Mississippi. Many of the traditional producing states such as Georgia and Maine have had only modest increases in production.

| State | Change in Production 1965 to 1972 |
|---|---|
| Arkansas | 67% |
| Virginia | 61 |
| Alabama | 53 |
| Mississippi | 53 |
| North Carolina | 29 |
| Texas | 26 |
| Maryland | 22 |
| Delaware | 21 |
| Georgia | 10 |
| Maine | 4 |

The five leading states reported a concentration of production among large producers (20,000+ capactiy or 100,000+ sales) about equal to the national average reflected in Table I-1.

| | Arkansas | Georgia | Alabama | North Carolina | Mississippi |
|---|---|---|---|---|---|
| Number of farms | 1,278 | 1,078 | 720 | 855 | 720 |
| Percent farms | 30.0 | 20.2 | 16.3 | 26.8 | 50.3 |
| Percent broilers sold | 56.8 | 44.8 | 46.6 | 54.4 | 44.5 |

During 1965-1972 turkey production became increasingly concentrated in ten major producing states. These ten states produced 77 percent of all birds in 1972 compared to 71 percent in 1965.

Minnesota, the leading state, produced 16.2 percent of all turkeys in 1972. California ranked second and was followed by North Carolina and Missouri. These four states alone produced 60.6 million birds in 1972, or 47 percent of U.S. production.

| Ten leading states | Percent of U.S. Production |
|---|---|
| Minnesota | 16.2 |
| California | 13.7 |
| North Carolina | 9.3 |
| Missouri | 7.8 |
| Arkansas | 6.3 |
| Texas | 6.1 |
| Iowa | 5.1 |
| Indiana | 4.7 |
| Virginia | 4.3 |
| Ohio | 3.2 |
| | 76.7 |

Significant shifts in turkey production have occurred since 1965. The Carolina's, Arkansas, Colorado, Pennsylvania, Indiana and Texas have had increases in production of 48 percent or more since 1965. The growth rate in the Carolina's between 1965 and 1972 exceeded 150 percent and North Carolina became the third largest producting state.

Traditional turkey producing states such as Iowa, Wisconsin, Virginia and West Virginia all experienced decreases in production. The number of birds raised in these states decreased by 3,723,000 million since 1965, an 18 percent decline.

The top twenty producing states ranked in order of percent change of state's production are as follows:

| State | Percent change 1965 - 1972 | Rank in 1972 |
|---|---|---|
| South Carolina | 169 | 15 |
| North Carolina | 156 | 3 |
| Arkansas | 70 | 5 |
| Colorado | 70 | 13 |
| Pennsylvania | 67 | 14 |
| Indiana | 51 | 8 |
| Texas | 48 | 6 |
| Utah | 36 | 12 |
| Georgia | 35 | 17 |
| Minnesota | 34 | 1 |
| Missouri | 32 | 4 |
| Oklahoma | 24 | 18 |
| Oregon | 20 | 16 |
| Ohio | 16 | 10 |
| California | 13 | 2 |
| North Dakota | 6 | 20 |
| Virginia | -3 | 9 |
| Iowa | -20 | 7 |
| Wisconsin | -26 | 11 |
| West Virginia | -30 | 19 |

Of the 140 large turkey producers (50,000+ capacity) in the United States in 1969, 75 were located in the ten leading states (Table I-17). These large producers play the largest relative role in production in Texas (48.5 percent), Minnesota (41.7 percent) and California (33.1 percent).

In the remainder of the leading states, large producers provide a percentage of total state production that is less than the 31.4 percent average for the country as a whole.

The five leading duck producing states (New York, Indiana, Wisconsin, California, and Illinois) produced 84 percent of all ducks in 1969 (Table I-9). New York, the major producer, produced 43 percent and Indiana, 20.9 percent. Production in New York is concentrated on Long Island.

Production in these sizes was accounted for almost entirely by large units (Class I farms of annual gross farm income of $40,000+). Average production for the 140 Class I farms in these states was over 84,000 birds per farm. Based on the number of producers and number of birds produced in other states, few, if any, large producers are located outside of the five leading states.

Table I-17. Number of farms raising 100,000+ turkeys (50,000+ bird capacity) and percent of state's turkeys sold, ten leading states, 1969

| State | Number of Farms | Percent of Farms | Percent of Turkeys Sold |
|---|---|---|---|
| Minnesota | 28 | 6.3 | 41.7 |
| California | 16 | 4.7 | 33.1 |
| North Carolina | - | - | - |
| Missouri | 5 | 1.2 | 11.4 |
| Arkansas | 5 | 2.3 | 20.6 |
| Texas | 10 | 2.4 | 48.5 |
| Iowa | - | - | - |
| Indiana | 2 | 0.6 | 5.9 |
| Virginia | 6 | 2.8 | 21.6 |
| Ohio | 3 | 1.1 | 9.6 |

Source: 1969 Agricultural Census

## C. Employment

Feedlot employment data are not available. The employment figures generated for this study are rough estimates as summarized in Table I-18.

There were more than 154,000 cattle feedlots of various sizes in the United States in 1972 and their labor requirements depend on their size and technology.

Commercial feedlots usually employ a manager, hired labor, and a bookkeeper if the operation is large enough. It was assumed in this study that for feedlots over 5,000 head capacity, the manager concerns himself predominately with management duties, relying upon hired labor for manual tasks. For feedlots with over 8,000 head capacity, a hired bookkeeper was assumed. Some family labor was assumed as well.

The rising productivity of feedlot technology (see Chapter I "Technology") and the above assumptions suggest the following feedlot employment estimates for 1972

| Feedlot capacity | Number feedlots | Average per feedlot | Estimated number employed |
|---|---|---|---|
| 1,000 - 1,999 | 912 | 1.8 | 1,642 |
| 2,000 - 3,999 | 484 | 3.5 | 1,694 |
| 4,000 - 7,999 | 311 | 6.3 | 1,960 |
| 8,000 - 15,999 | 216 | 11.7 | 2,527 |
| 16,000 - 31,999 | 125 | 19.2 | 2,400 |
| 32,000 or more | 59 | 34.6 | 2,100 |
| Total | | | 12,313 |

Ot the 12,313 total, an estimated 9,000 are hired labor. Assuming only one person is employed or partially employed for each farmer feeder operation, the 152,249 such operations bring the estimated total number employed or partially employed in the fed cattle industry to 164,562.

Of the 810,400 farms with hogs reported in 1972 [1] only 0.5 percent are assumed to have operations of 1,000 head capacity or greater. Labor requirements for large operations depend on the type of management system used. Under the assumption that modern technologies are being used, a farmer can take care of a farrow-to-finish hog operation of up to 50 sows. For larger operations, the operator will have to hire extra labor at the rate of one per additional 75 sows.

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[1] All farms; figures for 1969 given earlier reflected only those farms with gross sales of $2,500 or more.

Table I-18. Summary of estimated industry employment

| | Number large producers | Total number employed | Number hired | Total industry employment [1] |
|---|---|---|---|---|
| Cattle (1972) | 2,107 | 12,313 | 9,000 | 164,562 |
| Hogs (1972) | 2,443 | 12,000 | 8,000 | 908,000 |
| Dairy (1969) | 2,486 | 18,900 | 13,900 | 518,900 |
| Sheep (1969) | 3,690 | 10,000 | 3,000 | 150,000 |
| Layers (1969) | 3,128 | 6,453 | 1,500 | 43,616 |
| Broilers (1969) | 7,634 | 10,000 | -- | 36,054 |
| Turkey (1969) | 140 | 650 | 350 | 6,929 |
| Ducks (1969) | 147 | 441 | 100 | 5,300 |

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[1] Many of those indicated in the total industry employment figure are only partially employed.

Assuming an average size of 1,500 head for the large operations, in the neighborhood of 200 sows is implied. This will require the operator plus 2 hired workers. Based on these calculations, employment for the estimated 4,000 large hog operations will total 12,000 people. These people may be considered as employed nearly full time in the hog industry.

Similar calculations for the remaining hog producers suggest that 900,000 additional people are employed in hog production, with 80 percent employed part time.

Of the 568,237 farms reporting dairy cows in 1969, only 2,486 had 200 head or greater. Based on an assumed labor requirement of one worker for every 50 cows, required labor for these producers totals 18,900.

Assuming that an average of two people per farm are available as family labor in dairy operations, an estimated 13,900 of the labor requirement will be hired labor. Similar calculations with respect to smaller farms indicate further industry employment of about 500,000; as many as half of these must be considered only partially employed.

It would seem reasonable to assume that there are at least as many people employed in sheep production as there are farms reporting sheep and lambs. In 1969, 123,858 farms reported some inventory of sheep and lambs. A maximum of 150,000 people are estimated to be employed in sheep operations. The majority of these would not be fully employed. Employment in the 3,690 large sheep production operations is estimated at 10,000 people. Perhaps 3,000 of these represent hired labor. Lamb and sheep raising technology suggests that nearly all are employed part-time.

The number of people employed in egg production is estimated based on the number and size of flocks in 1969 and the assumption of one full time man per 25,000 layers, an assumption reflecting the extensive use of labor saving technology among large producers.

| Size of Flock | Number of Farms | Average Flock | Labor Requirement | Total Labor |
|---|---|---|---|---|
| 29,000-49,999 | 2,238 | 35,000 | 1.4 | 3,133 |
| 50,000-99,999 | 565 | 75,000 | 3.0 | 1,695 |
| 100,000-greater | 325 | 125,000 | 5.0 | 1,625 |
|  | 3,128 |  |  | 6,453 |

Of this total, 1,500 are estimated to be hired. Because very small egg production units require virtually no labor, employment among small egg-producers (less than 20,000 birds) is put at 37,223. About one half of these are part time.

The assumptions that broiler operations of 20,000+ bird capacity (there were 7,634 of these in 1969) are virtually the sole enterprise of the farm and that some very large producers require hired labor, suggest that 1969 full-time employment among large broiler producers was 10,000. Most were family labor. Typically labor is hired periodically to clean the chicken houses.

Estimated employment in the smaller scale broiler operations equals the number of such enterprises, 26,059. The majority of these will not be fully employed, since most small producers raise broilers to supplement other incomes.

As in the above industry segments, employment in the turkey industry must be estimated from data on the number and size of production units. Assuming that one man per 25,000 birds is required, employment in the 140 large turkey production units (50,000+ capacity) is estimted to be about 650 people in 1969. One third to one half would probably be hired and the rest, family labor. Based on the assumption of one man (the entrepreneur) per farm and additional labor for farms raising more than 25,000 birds, an additional 6,279 people are estimated to be employed by the smaller producers.

Little information about duck production is available. Employment would be at least equal to the 5,005 producers, of whom the 4,858 small producers are surely only partially employed. Assuming some additional labor (probably family labor) is required by the 147 large producers, industry employment is estimated at 5,300 people in 1969.

# II. FINANCIAL PROFILE

The impact analysis with which this study is ultimately concerned requires finite data definitions against which impacts may be measured. Unfortunately, the very nature of the feedlot industry makes economic data compilations impossible and, as a consequence, little reliable data exist. DPRA, as a result, projected industry data as representative model feedlot operations for the applicable segments (except sheep and duck feeding) of the industry. The models were based upon industry consultations and upon a survey of the industry's investment, cost, and financial data which have been published for selected states.

## A. Plants by Segment

Financial profiles have been developed for selected model feedlots for each of the segments, except for sheep and ducks. These model feedlots, organized by end-product and capacities (stated as "Size"), are shown in Table II-1. Annual production is a function of capacity ("Size") times turnover rate.

Operations smaller than those listed in Table II-1 are included in a separate report and are omitted here.

Data are not sufficient for large sheep and duck feeding operations to permit industry or model plant analysis.

### 1. Annual Profits and Cash Flows

Table II-2 summarizes the estimated profits and cash flows for the various model feedlots in each segment based on 1971 prices and costs.

The after-tax income was calculated by using a tax rate of 22 percent on the first $25,000 of income and 48 percent on income over $25,000.

Cash flows are reported as after-tax income plus depreciation.

These data were derived from the pro forma income and expense statements at the end of the chapter (Tables II-7 through II-18). The parameters used to estimate profits are presented in these statements.

Table II-2 is self-explanatory, except for the broiler segment data. Since broiler growers represented in this study are contract growers who do not buy feed or birds and who are not fully employed in this industry, the normal manner of measuring returns on investment and sales do not apply. The pre-tax profit reported is for family labor and return on investment and is the residual of grower receipts minus all costs, excluding family labor.

Table II-1. Representative model feedlots by size selected for financial profiles

| Industry segment (capacity) | Industry segment (capacity) |
|---|---|
| Fed cattle | Egg-layers |
| 1,000 | 30,000 |
| 5,000 | 50,000 |
| 10,000 | 100,000 |
| 20,000 | |
| Hogs | Broilers (Ga. & Maine) |
| 2,500 | 37,500 |
| Dairying | Turkeys |
| 700 | 55,000 |
| 1,000 | 100,000 |

Table II-2. Estimated income and cash flow for industry segments based on model feedlots, 1971

| Feedlot configuration | No. head | Pre-tax | | | After-tax | | | Cash flow | |
|---|---|---|---|---|---|---|---|---|---|
| | | Income | ROI | ROS | Income | ROI | ROS | Income | Percent Investment 1/ |
| | | ($000) | (pct) | (pct) | ($000) | (pct) | (pct) | ($000) | |
| **Fed Cattle** | | | | | | | | | |
| | 1,000 | 18 | 12 | 3 | 14 | 10 | 2 | 16 | 9 |
| | 5,000 | 91 | 14 | 3 | 54 | 9 | 2 | 63 | 8 |
| | 10,000 | 229 | 19 | 3 | 126 | 10 | 2 | 143 | 9 |
| | 20,000 | 517 | 21 | 4 | 275 | 11 | 2 | 306 | 13 |
| **Hogs** | | | | | | | | | |
| | 2,500 | 19 | 14 | 8 | 15 | 11 | 7 | 24 | 17 |
| **Dairying** | | | | | | | | | |
| | 700 | 36 | 8 | 5 | 25 | 5 | 4 | 30 | 7 |
| | 1,000 | 78 | 12 | 8 | 47 | 7 | 5 | 53 | 8 |
| **Egg-layers** | | | | | | | | | |
| | 30,000 | 4 | 9 | 2 | 3 | 7 | 2 | 6 | 13 |
| | 50,000 | 9 | 12 | 3 | 7 | 10 | 2 | 12 | 16 |
| | 100,000 | 24 | 17 | 4 | 19 | 13 | 3 | 29 | 20 |
| **Broilers** | | | | | | | | | |
| Georgia | 37,500 | 5 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Maine | 37,500 | 6 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Turkeys** | | | | | | | | | |
| | 55,000 | 9 | 5 | 2 | 7 | 4 | 2 | 22 | 12 |
| | 100,000 | 16 | 5 | 2 | 13 | 4 | 2 | 40 | 12 |

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1/ Investment excludes costs of land.

## 2. Market (Salvage) Value of Assets

Table II-3 presents the estimated replacement investment costs and salvage values for each industry segment. Land values have not been included in either original or salvage values. Most of the model feedlots would require a relatively small investment in land in relationship to total investment. It would be extremely difficult to estimate a land value which would reflect true opportunity costs for the acreage used in feedlots, since the type of land used varies widely and the land is generally a part of a larger farming operation. If the feeding operation were liquidated, the salvage value for alternative uses would depend upon a wide range of unknown factors. For these reasons, no land values have been calculated. Variations in salvage values by segment are discussed below. Net working capital is assumed to be 100 percent recoverable for all segments.

Fed cattle - The large commercial cattle feeder has little alternative use for his specialized facilities. Fixed assets are estimated to have a 10 percent salvage value.

Hogs - The model hog operation represents an open-lot system. Fenced pastures might be converted to a cattle enterprise, but equipment and shelters would have little alternative usefulness. A salvage value of 10 percent on buildings and equipment is believed realistic.

Brood sows are assumed to have a market value of approximately 60 percent of the original cost since sows can be sold for slaughter. The salvage value is estimated to be $68 for a 400-pound sow.

Dairying - Open lot dairy operations consist of fenced lots with shelters and a central milking building with equipment. The fences and shelter could have alternative uses, but the milking building is severely limited for other uses. For this reason, salvage values for buildings and equipment are placed at 10 percent.

Dairy herds have a high salvage value since the cows can be sold for slaughter and salvage value has been estimated at 50 percent ($250 per head).

Egg production - The alternate uses for the buildings are limited to other poultry enterprise (i.e., broiler production). An assumed salvage value of 10 percent has been used for buildings. Specialized equipment (for feeding, egg collecting and storage) would have some arbitrary value for the hardware involved. A 10 percent salvage value has also been assumed for equipment.

Broilers - The salvage values for broilers are comparable to those for egg production and have been computed on the same basis--10 percent for both buildings and equipment.

**Table II-3. Investment and salvage values by industry segment and feedlot size**

| Segment | Capacity No. head | Fixed investment (replacement) | Salvage values | Net working capital | Total salvage value |
|---|---|---|---|---|---|
| | | -------- | $000 | ----------------- | ----------------- |
| Fed cattle | | | | | |
| | 1,000 | 77 | 7.7 | 107 | 114.7 |
| | 5,000 | 304 | 30.4 | 478 | 508.4 |
| | 10,000 | 560 | 56.0 | 948 | 1,004.0 |
| | 20,000 | 1,040 | 104.0 | 1,890 | 1,994.0 |
| Hogs | | | | | |
| | 2,500 | 187 | 37.7 | 45.0 | 82.7 |
| Dairying | | | | | |
| | 700 | 577 | 213.0 | 55.0 | 268.0 |
| | 1,000 | 810 | 302.6 | 78.0 | 380.6 |
| Egg-layers | | | | | |
| | 30,000 | 63 | 6.3 | 13.0 | 19.3 |
| | 50,000 | 104 | 10.4 | 21.0 | 31.4 |
| | 100,000 | 205 | 20.5 | 42.0 | 62.5 |
| Broilers | | | | | |
| Georgia | 37,500 | 57 | 5.7 | 1.4 | 7.1 |
| Maine | 37,500 | 71 | 7.1 | 1.4 | 8.5 |
| Turkeys | | | | | |
| | 55,000 | 303 | 30.3 | 34.2 | 64.5 |
| | 100,000 | 551 | 55.1 | 60.7 | 115.8 |

Turkeys - The specialized buildings and equipment used in growing turkeys have quite limited alternative uses and have been assigned a salvage value of 10 percent of cost.

Replacement values are summarized for each segment in Table II-4.

### 3. Capital Structure

There are no precise guidelines for determining the capital structure for the various feedlot operations. Because wide variations in equity and debt capital ratios appear both among and within segments, certain assumptions concerning capital structure and type of financing (summarized in Table II-5 by segment) were necessary.

Long-term financing assumptions range from a low equity input of 50 percent for turkeys up to 75 percent for cattle and hog feeding. The range for short term financing is from 20 percent equity for cattle to 100 percent for broilers, where contract growing requires little working capital.

It should be noted that the invested capital in fixed assets for cattle feeding is low in relationship to sales, with a very high total working capital requirement. Fixed asset turnover (sales divided by fixed assets) varies from 8.6 for a 1,000 head capacity feedlot up to 12.8 for a 20,000 head capacity lot. The ratio is much lower for other segments. These ratios are as follows:

| Segment and Capacity | | Ratio Sales to Fixed Assets |
|---|---|---|
| Fed Cattle | 1,000 | 8.6 |
| | 5,000 | 10.9 |
| | 10,000 | 11.9 |
| | 20,000 | 12.8 |
| Hogs | 2,500 | 1.2 |
| Dairying | 700 | 1.1 |
| | 1,000 | 1.1 |
| Egg Production | 30,000 | 2.7 |
| | 50,000 | 2.7 |
| | 100,000 | 2.8 |
| Broilers (Ga.) | 37,500 | N.A. |
| (Me.) | 37,500 | N.A. |
| Turkeys | 55,000 | 1.5 |
| | 100,000 | 1.5 |

**Table II-4. Estimated replacement values of fixed assets, net working capital requirements and book value of invested capital**

|  | Size | (Replacement) Fixed assets | Net Working Capital | Total Invested Capital | Book Value[1] |
|---|---|---|---|---|---|
|  |  | --------------$000 | ------------------ | ------------------ | ------------------ |
| Fed Cattle | 1,000 | 77 | 107 | 184 | 145 |
|  | 5,000 | 304 | 478 | 782 | 630 |
|  | 10,000 | 560 | 948 | 1,508 | 1,228 |
|  | 20,000 | 1,040 | 1,890 | 2,930 | 2,410 |
| Hogs | 2,500 | 187 | 45 | 232 | 139 |
| Dairy cattle | 700 | 577 | 55 | 632 | 461[2] |
|  | 1,000 | 810 | 78 | 888 | 651[2] |
| Egg product | 30,000 | 63 | 13 | 76 | 45 |
|  | 50,000 | 104 | 21 | 125 | 73 |
|  | 100,000 | 205 | 42 | 247 | 744 |
| Broilers (Ga.) | 37,500 | 57 | 1 | 58 | 30 |
| (Me.) | 37,500 | 71 | 1 | 72 | 37 |
| Turkeys | 55,000 | 303 | 34 | 337 | 186 |
|  | 100,000 | 551 | 61 | 612 | 336 |

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[1] 50 percent of replacement cost of fixed assets, plus net working capital

[2] Book value of dairy cows calculated on basis of one fourth year replacement annually. Average book value per cow is $406.25, based on original cost of $500.

Table II-5. Capital structure assumptions for feedlot operations by segment

| | Fixed Assets | | | Total Working Capital | | |
|---|---|---|---|---|---|---|
| | Equity | Debt | Interest | Equity | Debt | Interest |
| | -------- percent --------- | | | ------- percent ---------- | | |
| Fed cattle | 75 | 25 | 7.5 | 20 | 80 | 9.0 |
| Hogs | 25 [1] | 75 | 7.5 | 50 | 50 | 9.0 |
| Dairying | 60 | 40 | 7.5 | 70 | 30 | 9.0 |
| Egg Production | 70 | 30 | 7.5 | 50 | 50 | 9.0 |
| Broilers | 55 | 45 | 7.5 | 100 | -- | -- |
| Turkeys | 50 | 50 | 7.5 | 50 | 50 | 9.0 |

[1] This estimate is based on a study, "Pork Production on a Business Basis," Cooperative Extension Service, Kansas State University, Manhattan, Kansas, October, 1970. It apparently assumes that hog producers have substantial equities in land and other improvements to offset this low equity in hog feeding buildings and equipment.

Net working capital (current assets minus current liabilities) estimates are also reported for each segment (Table II-5). The estimates assume that current assets are equal to total working capital and that some percentage of that total working capital is borrowed. The percentage of total working capital (current assets) represented by equity equals net working capital.

In each segment, total working capital was estimated, based on the patterns of revenue for operators. Where receipts are monthly, the assumption used is that an operator should have approximately two months' variable costs on hand at any accounting period. For segments with receipts over a longer period, working capital requirements were extended proportionately.

### 4. Cost Structure

The estimated cost structures for each of the model feedlot operations were developed from model feedlot budgets. A summary of costs appears in Table II-6.

The detailed pro forma income-expense statements for each model feedlot have also been prepared and appear at the end of this chapter. These contain varying degrees of cost breakdowns and show variations in costs for different size operations. The statements implicitly indicate the relationships of feed and live animal inputs to both total costs and sales.

## B. Ability to Finance New Investments

The ability of a feedlot operation to finance new investment for pollution controls is a function of the operation's profitability credit rating, financial resources, and the availability of external funds. These conditions vary among segments by geographic area and among operators within segments and regions; however, analyses of model plant data and agricultural credit conditions make broad generalizations possible.

Fed cattle operations appear to have adequate returns and cash flows and should experience little difficulty in financing new investment under similar conditions. The Production Credit Association, Farmers Home Administration and commercial banks have furnished credit in the past and should continue to do so. Internally generated funds should provide much of the new capital. The industry's cyclical profit patterns can seriously impair the ability to finance in any given year and sharply different conditions could change the financial outlook for this segment.

Hog producers, as represented by a 2,500 capacity feedlot, show a reasonable after-tax profit and cash flow as a percent of investment. Sources of credit are similar to those for cattle feedlot operations and have somewhat similar limitations based upon operator profitability and resources. Apparently hog producers can finance new investments of a reasonable magnitude, but excessive new investment requirements may tax the funding ability of these large producers.

Table II-6 . Estimated sales and costs by industry segment and feedlot size, 1971.

| Segment | No. Head Capacity | Annual Sales ($000) | Direct Costs: Animals $000 | Direct Costs: Animals % Sales | Direct Costs: Feed $000 | Direct Costs: Feed % Sales | Direct Costs: Other 1/ $000 | Direct Costs: Other 1/ % Sales | Total Direct $000 | Total Direct % Sales | Indirect Costs $000 | Indirect Costs % Sales | Depreciation $000 | Depreciation % Sales | Interest (long-term) $000 | Interest (long-term) % Sales | Total Costs $000 | Total Costs % Sales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fed Cattle | 1,000 | 664 | 434 | 65 | 160 | 24 | 48 | 7 | 642 | 97 | 1 | * | 2 | * | 1 | * | 646 | 97 |
| | 5,000 | 3,321 | 2,171 | 65 | 841 | 25 | 189 | 6 | 3,200 | 96 | 17 | * | 9 | * | 3 | * | 3,230. | 97 |
| | 10,000 | 6,641 | 4,342 | 65 | 1,681 | 25 | 336 | 5 | 6,359 | 96 | 31 | * | 17 | * | 5 | * | 6,412 | 97 |
| | 20,000 | 13,282 | 8,683 | 65 | 3,362 | 25 | 632 | 5 | 12,677 | 95 | 47 | * | 31 | * | 10 | * | 12,765 | 96 |
| Hogs | 2,500 | 225 | | | 141 | 62 | 39 | 17 | 180 | 80 | 12 | 5 | 9 | 4 | 5 | 2 | 206 | 92 |
| Dairying | 700 | 635 | 88 | 14 | 300 | 47 | 162 | 26 | 550 | 87 | 28 | 4 | 5 | * | 16 | 3 | 599 | 94 |
| | 1,000 | 908 | 125 | 14 | 420 | 46 | 221 | 24 | 766 | 84 | 37 | 4 | 6 | * | 21 | 2 | 830 | 91 |
| Egg Production | 30,000 | 171 | 41 | 24 | 92 | 54 | 18 | 11 | 151 | 88 | 12 | 7 | 3 | 2 | 1 | * | 167 | 98 |
| | 50,000 | 285 | 68 | 24 | 153 | 54 | 31 | 11 | 252 | 88 | 17 | 6 | 5 | 2 | 2 | * | 276 | 97 |
| | 100,000 | 570 | 135 | 24 | 304 | 53 | 60 | 11 | 499 | 98 | 32 | 6 | 10 | 2 | 5 | * | 546 | 96 |
| Broiler Production (Ga.) | 37,500 | 14 | | | | | 4 | 29 | 4 | 29 | 1 | 7 | 3 | 21 | 2 | 14 | 10 | 71 |
| (Me.) | 37,500 | 16 | | | | | 2 | | 2 | 13 | 2 | 13 | 3 | 19 | 2 | 13 | 9 | 56 |
| Turkey Production | 55,000 | 451 | 61 | 14 | 269 | 60 | 66 | 15 | 396 | 88 | 26 | 6 | 15 | 3 | 6 | 1 | 443 | 98 |
| | 100,000 | 821 | 112 | 14 | 490 | 60 | 118 | 14 | 720 | 88 | 47 | 6 | 28 | 3 | 10 | 1 | 804 | 98 |

1/ Including short-term interest

2/ Indirect costs other than depreciation and long-term interest

* Less than 1 percent.

Dairying operations, as represented by the model feedlots, show only moderate returns on investment. Such operators might find it difficult to raise large sums of money in tight credit markets. Large operators with newer facilities may generate sufficient cash flows to finance new investment internally. Operators with good credit ratings should be able to borrow additional investment funds; weak operators could encounter trouble.

Poultry producers face variations in their ability to finance new investments. Large egg producers show reasonable returns with adequate cash flows and should experience little difficulty. Broiler and turkey producers, on the other hand, will be limited by their personal resources and credit ratings. Marginal operators will undoubtedly encounter difficulty in borrowing. Turkey growers with high cash flows can generate limited financing through internal funds.

Table II-7. Proforma income statements and financial returns for selected model cattle feedlots.

| Item | Unit | Capacity - Number of head | | | |
|---|---|---|---|---|---|
| | | 1,000 | 5,000 | 10,000 | 20,000 |
| Invested capital | $1,000 | $145 | $630 | $1,228 | $2,410 |
| Sales[1] | $1,000 | 664 | 3,320 | 6,641 | 13,282 |
| Direct Expenses | $1,000 | 642 | 3,200 | 6,359 | 12,677 |
| Indirect expenses | $1,000 | 1 | 17 | 31 | 47 |
| Subtotal | $1,000 | 643 | 3,217 | 6,390 | 12,724 |
| Depreciation | $1,000 | 2 | 9 | 17 | 31 |
| Interest (long-term) | $1,000 | 1 | 3 | 5 | 10 |
| Subtotal | $1,000 | 3 | 12 | 22 | 41 |
| Total costs | $1,000 | 646 | 3,229 | 6,412 | 12,765 |
| Net Income before tax | $1,000 | 18 | 91 | 229 | 517 |
| Net income after tax | $1,000 | 14 | 54 | 126 | 275 |
| Cash flow | $1,000 | $ 16 | $ 63 | $ 143 | $ 306 |
| Return on investment | | | | | |
| before tax | Pct. | 12 | 14 | 19 | 21 |
| after tax | Pct. | 10 | 9 | 10 | 11 |
| Return on sales (after tax) | Pct. | 2 | 2 | 2 | 2 |

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[1] $307.45 per head = 10 cwt X .96 shrink X .99 death loss X 32.35/cwt

Table II-8. Estimated direct and indirect costs for selected model cattle feedlots.

| Item | Capacity - Number of head<br>1,000 | 5,000 | 10,000 | 20,000 |
|---|---|---|---|---|
| Throughput (head of cattle) | 2,160 | 10,800 | 21,600 | 43,200 |
| Direct Costs ($000) | | | | |
| Cattle | $434.2 | $2,170.8 | $4,341.6 | $8,683.2 |
| Ration | 159.8 | 840.5 | 1,680.9 | 3,361.8 |
| Labor (Hired) | 18.3 | 58.3 | 87.5 | 150.3 |
| Veterinary and Medical | 4.1 | 18.8 | 37.6 | 75.2 |
| Taxes (cattle) | 2.2 | 10.8 | 21.6 | 43.2 |
| Other | 8.6 | 28.6 | 44.5 | 72.6 |
| Interest - short term | 14.6 | 72.6 | 145.1 | 290.3 |
| Total | 641.8 | 3,200.4 | 6,358.8 | 12,676.6 |
| Indirect Costs ($000) | | | | |
| Insurance and taxes | 1.3 | 6.3 | 9.3 | 14.3 |
| Management | 1/ | 11.0 | 22.0 | 32.8 |
| Subtotal | 1.3 | 17.3 | 31.3 | 47.2 |
| Depreciation | 2.3 | 9.1 | 16.8 | 31.2 |
| Interest- long term | .7 | 2.9 | 5.3 | 9.8 |
| Total | 4.3 | 29.3 | 53.4 | 88.2 |
| Total Costs ($000) | $646.1 | $3,229.7 | $6,412.2 | $12,764.8 |

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1/ Included with labor

Table II-9. Proforma income statements and financial returns for selected model hog operations (farrowing to finish)

| Item | Amount |
|---|---|
| | ($000) |
| Invested capital | $ 138.5 |
| Sales[1] | 225.0 |
| Direct expenses | 179.6 |
| Indirect expenses | 11.8 |
| Subtotal | 191.4 |
| Depreciation | 9.4 |
| Interest (long-term) | 5.3 |
| Subtotal | 14.7 |
| Total costs | 206.1 |
| Net income before tax | 18.9 |
| Net income after tax | 14.7 |
| Cash Flow | $ 24.1 |
| Return on Investment | |
| Before tax Pct. | 13.6 |
| After tax Pct. | 10.6 |
| Return on Sales (after tax) Pct. | 6.5 |

[1] Price estimated at $20/cwt

Table II-10. Estimated direct and indirect costs for selected model hog operations (farrowing to finish)

| Item | Amount |
|---|---|
| Throughput (hundred weight) | 11,250 |
| Direct Costs ($000) | |
| Feed | $140.6 |
| Veterinary and medical | 5.0 |
| Utilities and fuel | 6.8 |
| Marketing | 6.0 |
| Taxes - breeding herd | .3 |
| Labor | 15.8 |
| Other | 1.1 |
| Interest - short term | 4.0 |
| Total | 179.6 |
| Indirect Costs ($000) | |
| Insurance and taxes | 3.8 |
| Management | 8.0 |
| Subtotal | 11.8 |
| Depreciation | 9.4 |
| Interest-long term | 5.3 |
| Total | 26.5 |
| Total Costs ($000) | $206.1 |

Table II-11 . Proforma estimated income and financial returns for selected model dairy operations

| Item | Number of Cows<br>700 | <br>1,000 |
|---|---|---|
| Invested capital ($000) | $461 | $ 651 |
| Sales | | |
| Milk ($6.20 cwt) | 564 | 806 |
| Calves ($39 per cow) | 27 | 39 |
| Cull cows ($250 each) | 44 | 63 |
| Total sales | 635 | 908 |
| Direct expenses | 550 | 766 |
| Indirect expenses | 28 | 37 |
| Subtotal | 578 | 803 |
| Depreciation | 5 | 6 |
| Interest (long-term) | 16 | 21 |
| Subtotal | 21 | 27 |
| Total Costs | 599 | 830 |
| Net income before tax | 36 | 78 |
| Net income after tax | 25 | 47 |
| Cash flow | $ 30 | $ 53 |
| Return on investment | | |
| Before tax Pct. | 8 | 12 |
| After tax Pct. | 5 | 7 |
| Return on sales after tax | 4 | 5 |

Table II-12. Estimated direct and indirect costs for selected model dairy operations

| | Number of Cows | |
|---|---|---|
| Item | 700 | 1,000 |
| Throughput (cwt of milk sold) | 91,000 | 130,000 |
| Direct Costs ($000) | | |
| Replacement cows | $ 88 | $ 125 |
| Ration | 300 | 420 |
| Breeding | 7 | 9 |
| Veterinary & medical | 13 | 18 |
| Utilities | 6 | 7 |
| Supplies | 3 | 3 |
| Milk hauling | 25 | 35 |
| Labor | 96 | 133 |
| Miscellaneous | 8 | 10 |
| Interest (short-term) | 4 | 6 |
| Total | 550 | 766 |
| Indirect Costs ($000) | | |
| Maintenance -repairs (2% inv.) | 11 | 14 |
| Insurance and taxes (1.5% inv.) | 8 | 11 |
| Management | 9 | 12 |
| Subtotal | 28 | 37 |
| Depreciation[1] | 5 | 6 |
| Interest (long-term) | 16 | 21 |
| Subtotal | 21 | 27 |
| Total Indirect | 49 | 64 |
| Total Costs ($000) | 599 | 830 |

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[1] On buildings and equipment only. Herd replacement and sale of cull cows account for herd depreciation.

Table II-13. Pro-forma income statements and financial returns for selected model egg production operations.

| Item | Size of flock, hens | | |
|---|---|---|---|
| | 30,000 | 50,000 | 100,000 |
| | ($000) | ($000) | ($000) |
| Invested capital | $ 44.5 | $ 73.0 | $ 143.5 |
| Sales (31.1¢/dozen) | 171 | 285 | 570 |
| Direct expenses | 151 | 252 | 499 |
| Indirect expenses | 12 | 17 | 32 |
| Subtotal | 163 | 269 | 531 |
| Depreciation | 3 | 5 | 10 |
| Interest (long-term) | 1 | 2 | 5 |
| Subtotal | 4 | 7 | 15 |
| Total Costs | 167 | 276 | 546 |
| Net income before tax | 4 | 9 | 24 |
| Net income after tax | 3 | 7 | 19 |
| Cash flow | $ 6 | $ 12 | $ 29 |
| Return on investment | | | |
| before tax pct. | 9 | 12 | 17 |
| after tax pct. | 7 | 10 | 13 |
| Return on Sales (after tax) pct. | 2 | 2 | 3 |

## Table II-14. Estimated direct and indirect costs for selected model egg production operations

| Item | Size of flock (hens) | | |
|---|---|---|---|
| | 30,000 | 50,000 | 100,000 |
| Throughput (000 doz eggs) | 550 | 917 | 1,833 |
| Direct costs ($000) | | | |
| Feed | $ 92 | $ 153 | $ 304 |
| Hen depreciation | 41 | 68 | 135 |
| Labor | 11 | 19 | 37 |
| Interest (short-term) | 1 | 2 | 4 |
| Other | 6 | 10 | 19 |
| Total direct | 151 | 252 | 499 |
| Indirect costs ($000) | | | |
| Maintenance, insurance and taxes | 4 | 7 | 14 |
| Management | 8 | 10 | 18 |
| Subtotal | 12 | 17 | 32 |
| Depreciation | 3 | 5 | 10 |
| Interest (long-term) | 1 | 2 | 5 |
| Total indirect | 16 | 24 | 47 |
| Total Costs | $167 | $276 | $546 |

---

1/ Including medication, sanitation, utilities.

### Table II-15. Proforma income statement and financial returns for selected model broiler operations

| Item | Model (30,000 square feet capacity) Georgia | Maine |
|---|---|---|
| | ($000) | ($000) |
| Invested capital | $ 30.2 | $ 37.0 |
| Sales[1] | 13.8 | 16.3 |
| Direct expenses[2] | 3.6 | 2.1 |
| Indirect expenses | .6 | 2.1 |
| Subtotal | 4.2 | 4.2 |
| Depreciation | 2.9 | 3.4 |
| Interest (long-term) | 1.9 | 2.3 |
| Subtotal | 4.8 | 5.7 |
| Total costs | 9.0 | 9.9 |
| Net income before tax[3] | 4.8 | 6.4 |

---

[1] 639.8 pounds less 2 percent condemnations X price (Southeastern price of $.022 per pound and Northeastern price of $.026 per pound).

[2] Excludes family labor.

[3] Residual of sales minus total costs is for family labor and return on capital. Cash flows and returns on investment cannot be calculated for broiler operations on the basis used for other segments.

Table II-16. Estimated direct and indirect costs for selected model broiler operations.

| Item | Model (30,000 square feet capacity) Georgia | Maine |
|---|---|---|
| Throughput[1] (1,000 pounds sold) | 639.8 | 639.8 |
| **Direct Costs** ($000) | | |
| Utilities | $ .4 | $ .7 |
| Heat | 1.5 | - |
| Litter | .9 | - |
| Labor (clean out)[2] | .2 | .4 |
| Repair and Maintenance | .4 | .5 |
| Other | .2 | .5 |
| Total | 3.6 | 2.1 |
| **Indirect Costs** ($000) | | |
| Insurance and taxes | .6 | 2.1 |
| Management[2] | - | - |
| Subtotal | .6 | 2.1 |
| Depreciation | 2.9 | 3.4 |
| Interest (long-term) | 1.9 | 2.3 |
| | 5.4 | 7.8 |
| **Total costs** ($000) | 9.0 | 9.9 |
| **Residual**[2] ($000) | $ 4.8 | $ 6.4 |

---

[1] (37,500 birds/lot X 5 lots/year) less 2.5 percent mortality X 3.5 pounds/bird sold.

[2] Residual of sales minus total costs is return to family labor and capital.

Table II-17. Proforma income statements and financial returns for selected model turkey feedlots.

| Item | Capacity - Number of birds | |
|---|---|---|
| | 55,000 | 100,000 |
| | ($000) | ($000) |
| Invested capital | 185.8 | 336.4 |
| Sales[1] | 451.4 | 820.8 |
| Direct expenses | 396.4 | 720.0 |
| Indirect expenses | 25.6 | 46.5 |
| Subtotal | 422.0 | 766.5 |
| Depreciation | 15.2 | 27.6 |
| Interest (long-term) | 5.7 | 10.3 |
| Subtotal | 20.9 | 37.9 |
| Total costs | 442.9 | 804.4 |
| Net income before tax | 8.5 | 16.4 |
| Net income after tax | 6.6 | 12.8 |
| Cash flow | $21.8 | $ 40.4 |
| Return on investment | | |
| before tax pct. | 4.6 | 4.9 |
| after tax pct. | 3.6 | 3.8 |
| Return on sales (after tax) | 1.5 | 1.6 |

---

[1] Average price of $.228 per pound

## Table II-18. Estimated direct and indirect costs for selected model turkey feedlots.

| Item | Capacity - Number of birds<br>55,000 | <br>100,000 |
|---|---|---|
| Throughput[1/] (1,000 pounds) | 1,980 | 3,600 |
| Direct Costs ($000) | | |
| Poults | $ 61.4 | $ 111.6 |
| Feed | 269.3 | 489.6 |
| Medical | 21.8 | 39.6 |
| Insurance | 4.0 | 7.2 |
| Utilities | 4.0 | 7.2 |
| Labor | 14.2 | 25.2 |
| Other | 5.9 | 10.8 |
| Interest (short-term) | 15.8 | 28.8 |
| Total | 396.4 | 720.0 |
| Indirect Costs ($000) | | |
| Insurance, taxes and maintenance | 25.6 | 46.5 |
| Management | - | - - |
| Subtotal | 25.6 | 46.5 |
| Depreciation | 15.2 | 27.6 |
| Interest (long-term) | 5.7 | 10.3 |
| Total | 46.5 | 84.4 |
| Total costs ($000) | $442.9 | $ 804.4 |

---

[1/] (55,000 birds/brood X 2 broods) less 10 percent mortality X 20 pounds/bird sold.

# III. PRICING

## A. Price Determination

Most segments of the feedlot industry are comprised of many producers, each producing so small a portion of the total supply that they are unable to independently influence industry prices. The equilibrium price in such a market is competitively determined by the interaction of supply and demand. Exceptions to and additional details concerning this general market situation and method of price determination are described below.

Cattle, hogs and sheep are marketed either through terminal and auction markets or sold directly to packers and country dealers. The trend is toward selling directly to the packer or country dealers (currently about 2/3 of the livestock) and away from selling through the terminal market (about 18 percent). Large producers may be able somewhat to negotiate prices with the packer or country dealers when selling directly, but the bargaining power of the seller is still generally low, for the packer or dealer can still buy elsewhere. Prices at terminal and auction markets are determined by area day-to-day supply and demand. Because in so competitive an industry livestock producers still act independently in marketing their product and no producer is large enough to independently influence the market, each producer remains a price taker.

Although dairy farmers cannot independently influence prices, many have joined milk marketing cooperatives which serve as their bargaining representative (some also process milk). In addition, federal and state programs directly or indirectly affect milk pricing. Two federal programs, for instance, are concerned with the pricing and marketing of milk.

The Federal Milk Marketing Order program establishes marketing orders regulating the terms under which regional milk dealers purchase milk from area farmers. These orders require that dealers pay farmers specified minimum prices based upon milk use classes. Milk for fluid use (generally whole milk, skim, low fat milk, milk drinks, flavored milk, and buttermilk) is placed in Class I, the highest priced class.

Class II milk is priced at levels approximating the prices paid at unregulated plants that manufacture dairy products such as butter and cheese. Farmers receive a weighted average or "blend price" for milk that reflects the amount of milk used for fluid consumption and for manufacturing purposes. In 1971, there were 62 federal orders handling 81 percent of all fluid milk sales in the U.S.; in 1950 such orders covered 50 percent of U.S. fluid milk sales.

Under the dairy price support program, the second federal program, the USDA sets a national average support price for manufacturing milk based upon a Minnesota-Wisconsin price series, a series reflecting the value of milk used in manufactured milk products. In December, 1971, the support price was $5.29 per hundred weight. This support price is used to calculate Class I prices for all market orders, and several factors determine the differential by which the Class I price exceeds the Minnesota-Wisconsin price for each market. These factors include the added cost of producing milk eligible for fluid use (Grade A), the costs of transporting supplies from producing areas, the conditions of market supply and demand and other economic factors. The differential between Class II, (manufacturing) milk and Class I generally increases with distance from the Minnesota-Wisconsin area. For example, the differential equalled $1.06 per cwt. for the Minneapolis-St. Paul order in December, 1971 and $3.07 in the Corpus Christie, Texas order.

In addition to the federal programs, some states have milk control programs. The authority of these programs vary from setting producer, wholesale and retail prices to establishing trade practice regulations (see Table III-1).

Bargaining cooperatives frequently have negotiated minimum Class I prices exceeding federally established prices. Eight large federations of milk marketing cooperatives control an estimated forty percent plus of the nation's milk supply.

Turkey, broiler, and egg producers market their products similarly and under contract production more often than open market selling. (Over 60 percent of production is on a contract basis.) Many independent egg producers process and distribute their own eggs. Each industry segment has many small producers (relative to the total market) who, acting independently, are unable to influence the market price.

Broiler producers commonly operate under production contracts and their prices are determined by the various patterns prevalent in the industry. Typically, the contracts stipulate that producers provide housing, utilities, feeding and watering equipment, and labor; the contractors provide birds, feed, medication and supervisory assistance. Prices paid to the producers will frequently be based upon growth yields and will, additionally, reflect such production efficiency standards as bird condemnation rates, mortality, and feed conversion rates. The degree of a grower's production efficiency will determine his receiving prices less than or in excess of the growth per pound price. The industry pricing is competitive to the degree that growers may choose among competing contractors. Typical contract patterns are as follows.

Feed conversion: Payment under this contract is based on feed conversion rate. The grower receives a payment of 1 to 2 1/2 cents per pound which depends upon his feed conversion rate per flock.

Prime cost: Under this contract, the grower receives a minimum guarantee per thousand birds started. A grower's subsequent payment reflects his average production costs relative to the average production costs for all of the contractor's growers during the two weeks prior to settlement. All profits above the guarantee are divided between the contractor and growers.

## Table III-1. States regulating milk prices and trade practices and authorizing milk promotion, January 1972.

| State | Minimum prices established at— | | | Trade practice regulations | Milk promotion |
|---|---|---|---|---|---|
| | Producer level | Wholesale level | Retail level | | |
| Alabama | X | X | [1]X | X | — |
| Arkansas | — | — | — | X | — |
| California | X | X | X | X | X |
| Colorado | — | — | — | X | X |
| Connecticut | — | — | — | X | X |
| Georgia | — | — | — | — | X |
| Hawaii | X | — | — | — | [2]X |
| Idaho | — | — | — | X | X |
| Iowa | — | — | — | X | — |
| Kentucky | — | — | — | X | — |
| Louisiana | X | X | X | X | X |
| Maine | X | X | X | X | X |
| Massachusetts | X | (3) | (3) | X | [4]X |
| Minnesota | — | — | — | X | [3]X |
| Missouri | — | — | — | X | — |
| Montana | X | X | X | X | — |
| Nebraska | — | — | — | X | — |
| Nevada | X | X | X | X | — |
| New Hampshire | — | — | — | — | X |
| New Jersey | X | X | X | X | X |
| New York | X | — | — | X | [3]X |
| North Carolina | X | (3) | (3) | X | — |
| North Dakota | X | X | [1]X | X | X |
| Oklahoma | — | — | — | X | — |
| Ohio | — | — | — | — | [3]X |
| Oregon | (5) | — | — | — | X |
| Pennsylvania | X | X | X | — | [3]X |
| South Carolina | X | X | X | X | — |
| South Dakota | — | X | X | X | X |
| Tennessee | — | — | — | X | — |
| Utah | — | — | — | — | X |
| Vermont | X | X | X | X | X |
| Virginia | X | [1]X | [1]X | X | — |
| Washington | — | — | — | — | X |
| West Virginia | — | — | — | — | X |
| Wisconsin | — | — | — | X | X |
| Wyoming | X | X | — | X | — |
| Puerto Rico | X | [1]X | [1]X | X | X |

X = yes; — = No.

[1] Also establishes maximum prices.

[2] Industrywide agreement on Oahu, coordinated by State.

[3] Authorized but not used.

[4] The Milk Control Law states "... to promote programs designed to increase the consumption of milk."

[5] The State's Class I base plan is used to repool Oregon-Washington Federal milk order producer payments if requested by individual Oregon producers.

Cost of production grouping: Under this contract, growers are paid from 1 1/2 to 2 1/4 cents per pound of broilers raised. Payments are determined by comparing each grower's cost of production to that of the contractor's most efficient grower.

Feed conversion-body weight: Growers operating under this pattern receive a base payment of 1 1/2 cents per pound and bonuses are based upon feed conversion rates and average broiler weight.

Prime production costs: This contract provides that growers receive 2 cents per pound plus or minus the full amount of the difference between their cost of production and the average cost for all growers. Minimum payment is guaranteed not to be less than 1.5 cents per pound.

The price received by a turkey producer depends upon the type of production and marketing arrangement contracted with a processor. The returns to a grower and the risks involved will vary by type of contract.

Production payment contract: Under this pattern, contractors pay producers a stipulated per pound price for turkeys marketed and the prices may vary by mortality and feed efficiency rates.

Floor price contract: This contract provides that growers own the birds, assume all production risks, and share price risk with the contractor. The producer, in turn, receives a price -- no lower than a fixed minimum -- based upon schedule of prices that reflect market prices. The grower trades part of his potential profit if market prices are high for a guaranteed floor price if they are low.

Marketing contract: Under this contract, a contractor processes and markets a producer's birds and returns to him the net proceeds above processing, storage, and other costs.

Financing contracts: Under this pattern, a grower owns the birds and assumes all production and price risks. In return for the contractor's financing the turkey production, the grower buys the contractor's feed and/or sells the finished birds to the contractor.

A small number of producers supply the nation's ducks. Some duck operations are totally integrated through growing, processing and product distribution. One large duck grower who supplies 16 percent of U.S. duck supply contracts with other duck producers to provide birds for his integrated operation.

## B. Demand

### 1. Retail Demand

Livestock and poultry per capita consumption trends for 1950-1971 are shown in Figures III-1 and III-2. In all cases, the observed quantity consumed reflects both supply and demand factors.

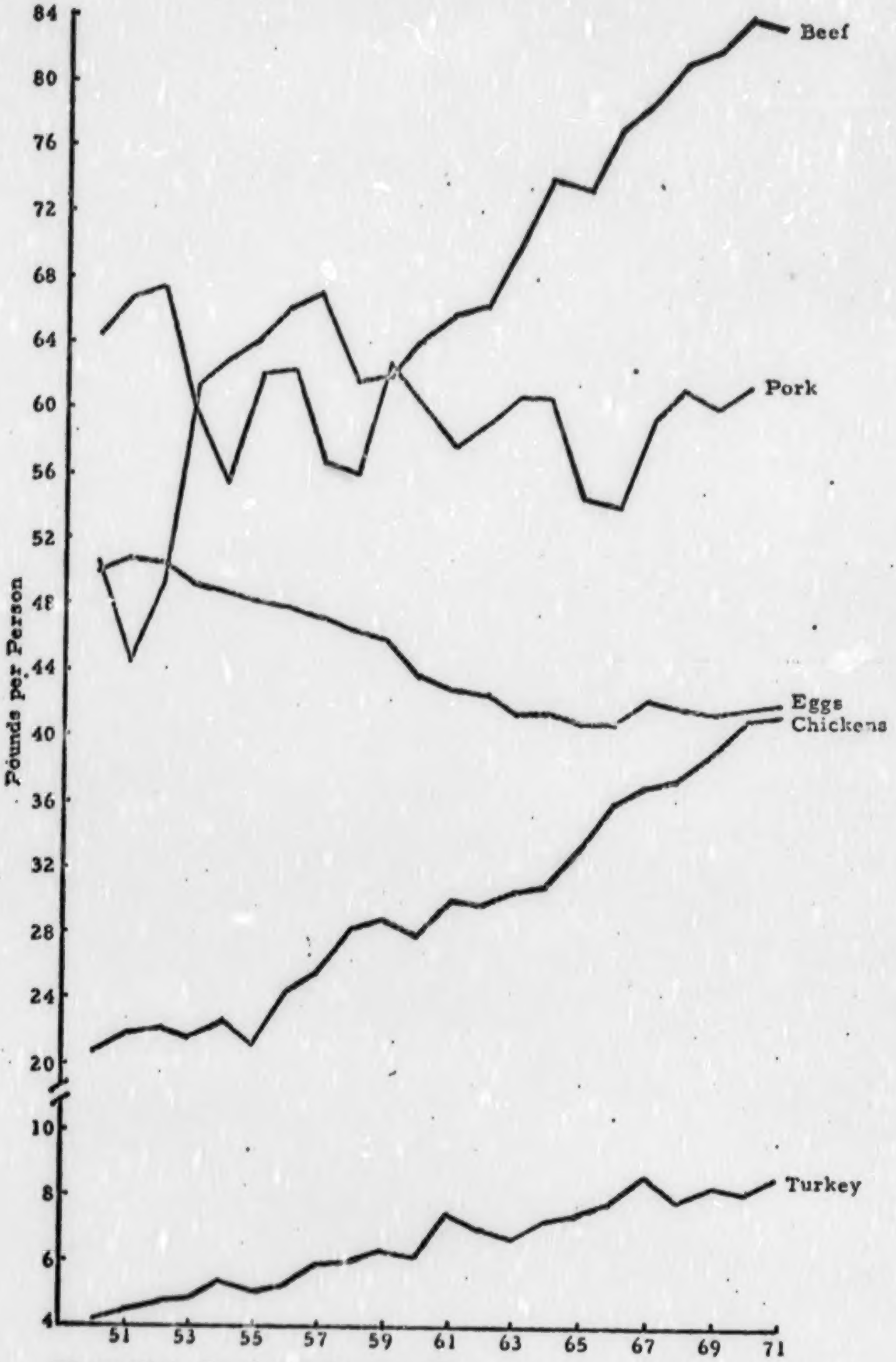

Figure III-1. Per Capita Consumption

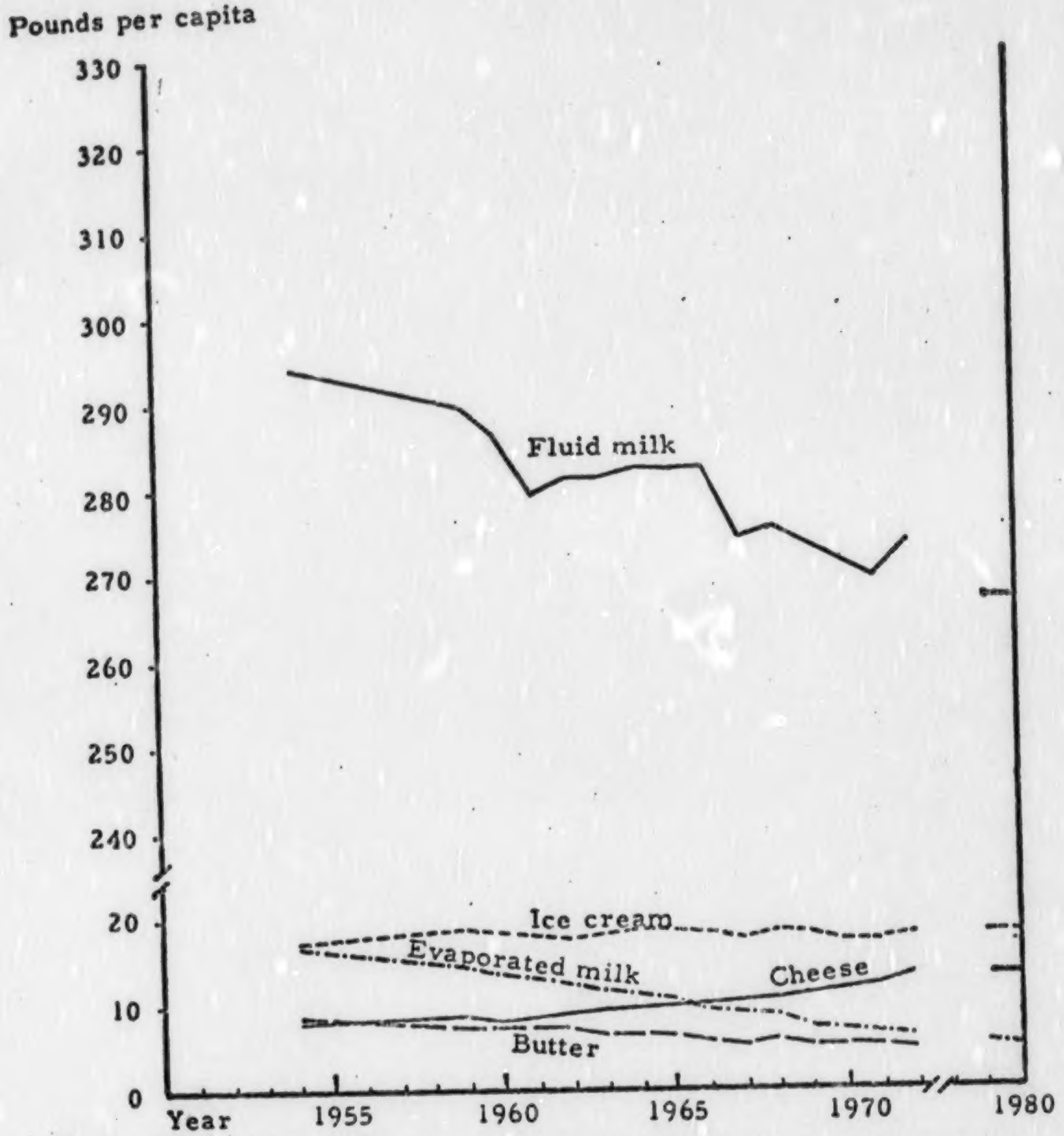

Figure III-2. Per capita consumption of selected dairy products in the U.S. for selected years 1954-1972, with a forecast to 1980.

Note: 1972 Data are preliminary
Fluid milk consumption is based on the product weight
of the Economics Research Service, USDA Research Seri

Source: George, P.S. and G. A. King. Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph #26, March, 1971, University of California.

Beef consumption increased considerably during the 1950-1971 period. When observed with the rising retail price trend over these years, the beef consumption trend clearly indicates that the beef demand curve has been shifting outward. While this is explained largely by increases in consumer income, a shift in consumer preference in favor of beef may also have occurred. The 1971 decline resulted from supply limitations.

Per capita chicken consumption has also increased considerably, from 20.6 lbs. in 1950 to 41.6 lbs. in 1971. In contrast to beef consumption, however, the increasing trend has been accompanied by a price decline -- \$.60/lb in the early 1950's to \$.43/lb in 1971. If the demand curve for chicken has shifted outward (e.g. due to increased consumer income), it is clear that the supply curve has shifted outward to an even greater extent and has resulted in price declines. The price elasticity of demand for chicken is estimated at -0.777; thus, the 30 percent decline in price over this period, which, given demand, would reflect an increase in supply, would account for a 23 percent increase in the quantity consumed, which is less than one-fourth of the observed increase in consumption. The remaining increase in consumption reflects the shifts in demand and supply.

Per capita pork consumption from 1952 to 1971 fluctuated in a fairly regular pattern between 54 lb. to 63 lb. per person. A slight downward trend is observable. Pork prices have increased from \$.50/lb. in 1950 to \$.687/lb. in 1971 and may alone account for the decline in pork consumption although a change in consumer preference away from pork may also have occurred. The income elasticity of pork demand is estimated to be very small (near zero).

The per capita consumption of eggs declined continuously from about 51 lbs. per person in 1951 to about 41 lbs. in 1965. During that period, though prices fluctuated, they generally declined. Since 1966, egg prices have fluctuated widely while per capita egg consumption has remained stable.

A study by King and George 1/ detected a statistically significant negative time trend of more than 5 percent per year in the consumption of eggs that probably reflects changes in eating habits and the public's awareness of their high cholesterol content. Most eggs are purchased as shell eggs, primarily for breakfast use. Declines in the percent of households eating breakfast plus the growth of convenience foods have resulted in the decline of the consumption of shell eggs. The consumption of processed eggs or eggs incorporated in other food items has increased, but the increase is small when compared with the decline in shell egg

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1/ George, P. S. and G. A. King. Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph # 26, March, 1971, University of California.

consumption. These considerations may explain the decline in both prices and per capita consumption during the 1951-1965 period. The income elasticity of demand has been estimated to be near zero. This is consistent with the nearly unchanged consumption since 1965.

Turkey consumption increased from 4.1 lbs. in 1950 to 8.5 lbs. in 1971, and the limited price data indicates that turkey prices have increased moderately. The price elasticity of turkey demand is estimated to be -1.55, indicating that a given percentage increase in price will result in an even larger percentage decline in consumption. The demand for turkey is relatively more income elastic than most food items, having an estimated value of 0.768. An outward shift in the demand curve due to the increase in consumer incomes over the years would, therefore, account for most of the observed increase in per capita turkey consumption.

Although the consumer demand for dairy products in general has diminished slightly, individual product consumption trends are mixed (Figure III-2). The general decline in the per capita consumption of fluid milk since 1955 stopped in 1972. Evaporated milk consumption continues to decline. Ice cream consumption remains stable at just under 20 pounds per person; cheese consumption has increased, with a continuous upward trend since 1960 and an acceleration since 1971. The latter is attributed to the substitution of cheese for meat as prices have increased.

Lamb and mutton consumption remains low, and has declined slightly to about 4 lbs. per person. No precise data are available on the consumption and the retail prices of ducks, but production has increased from 54 million lbs. in 1959 to 69 million lbs. in 1971. Per capita consumption is about one-fourth pound.

## 2. Demand Projections

Projecting an accurate product demand is exceedingly difficult, therefore, the following estimates are quite approximate. The projections are based upon an extension of observed trends and reflect recent changes in demand determinants. In addition, the estimated income elasticities of demand given in the previous section are continued.

The demand for meat, poultry, and dairy products can be expected to increase as the population increases. Official estimates project a 10-14 percent increase in population between 1970 and 1980 1/. The demand projections offered below are in per capita terms and assume the actual consumption of the various products will result from both demand and supply changes and, hence, future product prices. In addition, the projections assume that shifts in supply will keep approximately pace with the projected shifts in demand.

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1/ Bureau of Census, Department of Commerce, "Population Estimates and Projections," Current Population Reports No. 470, November, 1971.

The demand for and per capita consumption of beef are expected to continue to increase, though less rapidly than over the past decade.

The demand for pork is expected to remain stable. Reflecting the fluctuation in product supply seemingly inherent to the industry, consumption per capita will probably continue to alternately rise and fall.

The present consumption of chicken already exceeds George and King's estimate of 39 lbs. per person for 1980. The increased demand for chicken, though it may moderate somewhat, should continue. Since beef and chicken are substitutes in consumption, beef prices will influence the demand for chicken (and vice versa). With some moderation of present trends, per capita chicken consumption may reach 45 lbs. by 1980.

The demand for eggs appears to have stabilized in the last six years. George and King's estimate of egg consumption at 41 lbs. per person in 1980 appears reasonable and represents a modest decline in egg consumption consistent with a stable or slightly decreased demand.

The demand for turkey is expected to continue gradually shifting outward. Based on this projection, per capita consumption will approach 10 lbs. per capita by 1980. Lamb and mutton demand will continue its slow decline with consumption dropping from the 1962-66 average of 3.9 lbs. per capita to 3.1 lbs. in 1980.

Projecting the apparent decline in the demand for milk, per capita consumption of fluid milk should decline to about 265-270 lbs. per person by 1980. The increase in the demand for cheese is expected to continue, with consumption reaching 14 lbs. per person.

The negative June trend in evaporated milk consumption is expected to persist; consumption in 1980 is projected at 5 lbs. per capita. Based on a positive income elasticity of demand, the consumption of ice cream should reach 20 lbs. per person by 1980. A positive income elasticity and a negative time trend largely offset one another and project butter consumption at an estimated 4.9 lbs. per person in 1980.

The demand for duck and per capita duck consumption should be unchanged.

### 3. Farm Level Demand

The demand for livestock and poultry products is estimated to be more inelastic at the farm level than at the retail level. Estimates of the price elasticities of demand for the products are as follows:

| | Price Elasticity of Demand-Farm Levels |
|---|---|
| Beef | -0.416 |
| Pork | -0.241 |
| Lamb and mutton | -1.670 |
| Chickens | -0.602 |
| Turkey | N.A. |
| Eggs | -0.225 |
| Milk | -0.323 |
| Duck | N.A. |

Source: George, P.S. and G. A. King. Consumer Demand for Food Commodities in the U.S. with Projections for 1980, Giannini Foundation Monograph #26, March, 1971. University of California

The demand for lamb and mutton is most responsive to price changes at the farm level. A one percent increase in price reduces the quantity demanded by 1.67 percent. Chickens are next with a price elasticity of -0.602. Price elasticity of demand for beef, at the farm level, is -0.416, indicating that a one percent decline in price would result in a 0.4 percent increase in the quantity demanded. With inelastic demand coefficients, a small decrease in the quantity demanded. With inelastic demand coefficients, a small decrease in the quantity offered by producers will result in a larger percentage increase in price at the farm level.

## C. Supply

Cattle feedlots are but one segment of the beef industry. Supplied with feeder cattle by cow-calf operations, the industry's supplies are determined by the size of breeding herds. Considering the length of the biological processes involved, the number of cattle available for slaughter is a function of production (breeding) decisions made by brood cow-calf producers nearly three years earlier. The supply of slaughter cattle is, thus, highly inelastic in the short run.

The long run supply of slaughter cattle is more elastic. Since the production of feeder cattle is dependent, in part, on cow-calf producers deciding to save more calves for breeding stock, a considerable time lag exists between this decision and the increased availability of slaughter cattle; consequently, production and prices tend to follow 10-12 year cycles. (The cycle does not necessarily involve absolute increases and decreases in production and price, but rather it increases and decreases relative to a basic time trend.) During a period of high slaughter cattle prices, feeders bid up feeder cattle prices which, with a time lag, encourages cow-calf producers to save more calves for increased breeding. This may result in a relative oversupply of slaughter cattle several years later. Cattle prices then weaken, and the reverse adjustment process begins.

Table III-2 shows average prices and total marketings for each feedlot industry product from 1950 to 1971. Some cyclical behavior in cattle prices and quantities relative to trend can be detected.

The major changes in the beef industry during the post-World War II period have been the increase in the proportion of fed beef and in the size and number of commercial feedlots. Large commercial feeders are more sensitive to input prices than are the small farmer-feeders who raise their own feed and feeder cattle; consequently, industry supply has become more sensitive to these cost factors.

Hog prices and production also tend to follow cyclical patterns. The cycles are much shorter (about 4 years) and more pronounced than are the cycles for cattle. (The shorter cycle is attributable to the shorter biological production period involved.) Confinement hog producers tend to operate near full capacity as long as receipts cover variable costs. The entry of new producers during periods of high prices and the exit of some producers when prices are low accounts for the rise and fall of quantities produced.

Hog production has been shifting from farm lot to confinement feeding, and the latter is typically larger than the average farm lot operation. The higher investment costs of confinement feeding have encouraged producers to practice continuous farrowings (rather than only the twice a year typical of farmlot operations) in order to more fully utilize their facilities; however, it is not clear that this has resulted in either a lower cost per hog produced or in reduced hog prices (in real terms).

Production systems and supply conditions for broilers, eggs and turkeys have evolved similarly. The supply of broilers has increased steadily and substantially during the last two decades, from 631 million birds in 1950 to 3 billion birds in 1972. Since the farm price for broilers has decreased from 27 to 14.2 cents per pound over the same period, there has been a strong outward shift of the supply curve. Because turkey production increased from 1,901 million pounds in 1965 to 2,424 million pounds (about 28%) while prices rose by about 20 percent, the supply curve for turkeys has probably shifted outward also.

**Table III-2. Marketings of livestock and poultry, liveweight basis, 1950 to 1972, U.S.**

| | Beef | | Pork | | Lamb & mutton | | Turkeys | | Broilers | | Eggs | | Ducks | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Sales live wt. | Average Price All Cattle | Sales live wt. | Average Price All hogs | Sales live wt. | Average Price lambs | Sales live wt. | Average Price turkeys | Sales live wt. | Average Price broilers | Sales live wt. | Average Price eggs | Sales live wt. | Average Price ducks |
| | billion pounds | per/cwt. | billion pounds | per/cwt. | billion pounds | per/cwt. | billion pounds | per lb. | billion pounds | per lb. | billion pounds | cents/lb. | million pounds | |
| 1971 | 40.6 | $36.30 | 22.9 | $17.50 | 1.0 | $25.90 | 2.3 | 22.1¢ | 10.8 | 13.7¢ | 9.4 | 31.4 | 69 | NA |
| 1970 | 39.5 | 34.50 | 22.9 | 22.70 | 1.1 | 26.40 | 2.2 | 22.6 | 10.8 | 13.6 | 9.1 | 39.1 | 74 | " |
| 1969 | 37.1 | 31.50 | 20.5 | 22.20 | 1.0 | 27.20 | 2.0 | 22.4 | 10.0 | 15.2 | 9.0 | 40.0 | 72 | " |
| 1968 | 36.4 | 27.60 | 21.1 | 18.50 | 1.1 | 24.40 | 2.0 | 20.5 | 9.3 | 14.2 | 9.0 | 34.0 | 65 | " |
| 1967 | 35.9 | 26.30 | 20.6 | 18.90 | 1.1 | 22.10 | 2.3 | 19.7 | 9.2 | 13.3 | 9.1 | 31.2 | 64 | " |
| 1966 | 35.0 | 26.00 | 19.1 | 22.80 | 1.2 | 23.40 | 2.1 | 23.1 | 9.0 | 15.3 | 8.7 | 39.1 | 67 | " |
| 1965 | 34.0 | 22.00 | 18.1 | 20.60 | 1.2 | 22.80 | 1.9 | 22.1 | 8.1 | 15.0 | 8.6 | 33.7 | 67 | " |
| 1964 | 34.8 | 20.40 | 20.2 | 14.80 | 1.3 | 19.90 | 1.8 | 21.0 | 7.5 | 14.2 | 8.5 | 33.8 | 68 | " |
| 1963 | 32.8 | 24.00 | 21.0 | 14.90 | 1.4 | 18.10 | 1.7 | 22.3 | 7.3 | 14.6 | 8.3 | 34.5 | 66 | " |
| 1962 | 30.8 | 25.10 | 20.3 | 16.30 | 1.5 | 17.85 | 1.6 | 21.6 | 6.9 | 15.2 | 8.3 | 33.8 | 60 | " |
| 1961 | 29.9 | 23.70 | 20.2 | 16.60 | 1.6 | 15.80 | 1.9 | 18.9 | 6.8 | 13.9 | 8.1 | 35.6 | 61 | " |
| 1960 | 28.8 | 22.90 | 19.2 | 15.30 | 1.6 | 17.90 | 1.5 | 25.4 | 6.0 | 16.9 | 8.0 | 36.1 | 62 | " |
| 1959 | 28.3 | 26.70 | 21.3 | 14.10 | 1.7 | 18.70 | 1.4 | 23.9 | 5.8 | 16.1 | 8.3 | 31.4 | 54 | " |
| 1958 | 26.8 | 25.30 | 19.2 | 19.60 | 1.7 | 21.00 | 1.4 | 23.9 | 5.4 | 18.5 | 8.0 | 38.5 | NA | " |
| 1957 | 26.6 | 18.70 | 18.4 | 17.80 | 1.5 | 19.90 | 1.4 | 23.4 | 4.7 | 18.9 | 8.0 | 35.9 | " | " |
| 1956 | 27.5 | 16.10 | 19.1 | 14.40 | 1.6 | 18.50 | 1.3 | 27.2 | 4.3 | 19.6 | 8.0 | 39.3 | " | " |
| 1955 | 28.1 | 16.80 | 20.2 | 15.00 | 1.6 | 18.40 | 1.1 | 30.2 | 3.4 | 25.2 | 7.8 | 39.5 | " | " |
| 1954 | 27.6 | 16.50 | 18.2 | 21.60 | 1.6 | 19.10 | 1.2 | 28.8 | 3.2 | 23.1 | 7.7 | 36.6 | " | " |
| 1953 | 27.4 | 16.70 | 16.8 | 21.40 | 1.5 | 19.30 | 1.0 | 33.7 | 2.9 | 27.1 | 7.6 | 47.7 | " | " |
| 1952 | 24.9 | 25.80 | 19.7 | 17.80 | 1.5 | 24.30 | 1.0 | 33.6 | 2.6 | 28.8 | 7.6 | 41.6 | " | " |
| 1951 | 23.0 | 31.90 | 21.4 | 20.00 | 1.4 | 31.00 | 1.0 | 7.5 | 2.4 | 28.5 | 7.6 | 47.7 | " | " |
| 1950 | 21.2 | 26.30 | 20.2 | 18.00 | 1.3 | 25.10 | 0.8 | 32.9 | 1.9 | 27.4 | 7.7 | 36.3 | " | " |

Egg production has increased gradually since 1965. Prices have fluctuated, but 1972 prices are similar to those of 1965. This suggests some outward shift of the supply curve.

In all three industry segments, the increased production has been concentrated in larger production units and with new technology. This has resulted in increased efficiency and reduced costs per unit of output (in real terms).

Duck production has increased somewhat, but little price data are available.

The production of milk is being concentrated on a decreasing number of farms and with fewer dairy cows; however, increases in production per cow and per farm have resulted in a relatively stable supply of milk.

Milk prices are strongly influenced by the U.S.D.A. price support programs which are designed to ensure an adequate supply of milk for domestic consumption by maintaining a stable product price.

# IV. ECONOMIC IMPACT ANALYSIS METHODOLOGY

The economic impact analysis utilized the basic industry information developed in Chapters I-III plus that concerning pollution abatement technology and costs provided by the Environmental Protection Agency. The impacts examined included:

Price effects
Financial effects
Production effects
Employment effects
Community effects
Other effects

The required impact analysis was not a simple sequential analysis, but rather, it utilized a number of interacting steps on feedback. The schematic of the analytical approach is shown in Figure IV-1.

In general, the impact analysis is the same as that generally used in capital budgeting studies of new investments. Simply stated the problem is one of deciding whether a commitment of time or money to a project is worthwhile in terms of its expected benefits. The decision in this case is complicated by the fact that benefits and investments will accrue over a period of time and that, in actuality, no analyst can fully comprehend all of the required information which deal with projections of the future. In the face of imperfect, incomplete information and time constraints, the industry segments were reduced to money relationships insofar as possible, and the key, non-quantifiable factors were incorporated into the analysis to modify the quantified data. The latter process is particularly important in view of the use of model plants in the financial analysis. In practice, actual plants will differ from the models, and these differences must necessarily be considered in any interpretation of analytic data reflecting the behavior of model plants.

## A. Fundamental Methodology

Much of the underlying analysis regarding price, financial, and production effects is applicable to all other impact effects; consequently, the case methodology described here is conceptually integrated and specific impact interpretations are discussed under their appropriate headings.

The core conceptual data used in this analysis were the physical and financial characteristics of the various industry segments as projected on the basis of model plants. The estimated cash flows for these model plants were summarized in Chapter II.

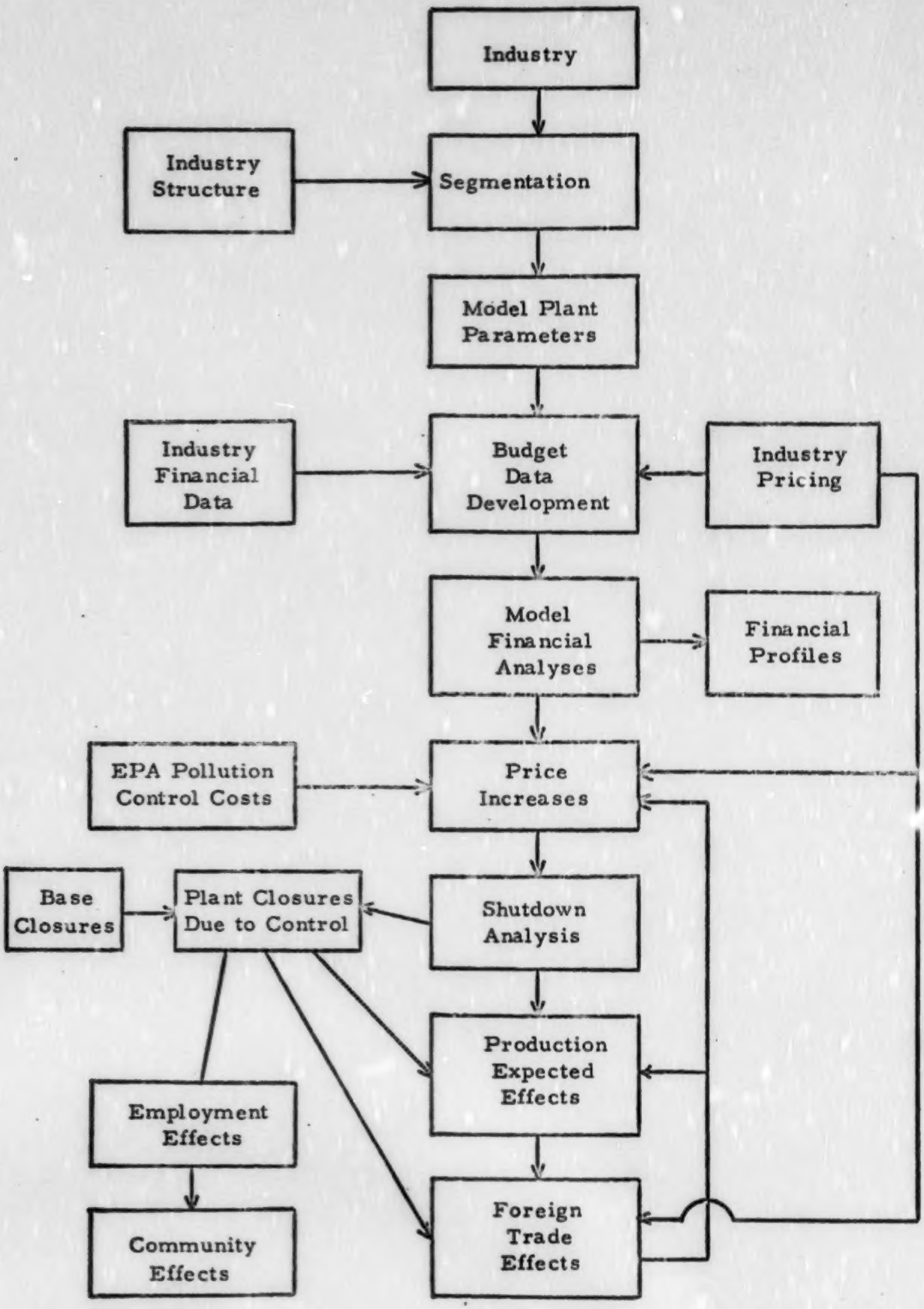
Industry
Industry Structure
Segmentation
Model Plant Parameters
Industry Financial Data
Budget Data Development
Industry Pricing
Model Financial Analyses
Financial Profiles
EPA Pollution Control Costs
Price Increases
Base Closures
Plant Closures Due to Control
Shutdown Analysis
Production Expected Effects
Employment Effects
Community Effects
Foreign Trade Effects

Figure IV-1. Schematic of impact analysis of effluent control guidelines.

The primary factors involved in assessing the financial and production impacts of pollution controls are profitability changes, and these, in turn, are a function of the cost of pollution control and the ability to pass along these costs in higher prices. In reality, of course, closure decisions are seldom made on the basis of well-defined common economic rules; such decisions invariably include a wide range of personal values, external forces such as the ability to obtain financing, or the role of the production unit in an integrated larger cost center.

Such variables include but are not limited to the following conditions and are generally characteristic of proprietorships and closely held enterprises rather than publicly held corporations.

1. Production units may lack sufficient financial accounting data. This is more likely to occur among small operators who do not have effective cost accounting systems.

2. Production units may be so old and fully depreciated that management has no intention of replacing or modernizing them. Production continues only so long as it covers labor and materials costs and/or until the equipment becomes inoperative.

3. Marginally productive units may be acquired by new ownership that can reevaluate existing assets or that can absorb temporary low returns with the expectation of eventual acceptable profit returns.

4. Production unit ownership may have value as psychic income. Such ownership, that is, may answer personal values that are great enough to override rational economic decisions.

5. The production unit, if part of a larger economic entity, may (1) use raw materials produced in another plant within the firm that must have an assured market or (2) supply raw materials to another unit within the firm. When the profitability of the second operation offsets the losses in the first plant, the unprofitable operation may continue indefinitely because the total enterprise is profitable.

6. The owner-operator expects that adverse conditions and consequent losses are temporary. His ability to absorb short-term losses depends upon his access to funds through credit or personal resources not presently utilized.

7. There are very low (approaching zero) opportunity costs for the fixed assets and for the owner-operator's managerial skills and/or labor. As long as the operator can meet labor and materials costs, he will continue to operate. He may even operate with gross revenues below variable costs until he has exhausted his working capital and credit.

8. Production units may also continue to function if the value of the land on which the plant is located is appreciating at a rate sufficient to offset short-term losses, if funds are available to meet operating needs, and if opportunity costs of the owner-operator's managerial skills are low.

While the above variable factors are frequently relevant to business decisions, economic rules are commonly universal. Thus, to provide useful and reliable insights into potential business responses to new investment decisions involving pollution control facilities, economic analyses were used as the core analytical procedure. Given known pricing conditions, the impact of pollution control costs and resulting prices on profitability can be determined by employing the ROI (or any other) profitability measure under conditions of the new price and incremental investment in pollution control. The primary consequence of profitability changes is the impact on the plant which determines either plant shutdown or increased investment to pollution control requirements.

In the most fundamental case, a plant will close when variable expenses (Vc) are greater than revenues (R). However, in practice plants may continue to operate where Vc > R under such conditions as:

- a lack of cost accounting detail to determine when Vc > R,
- the opportunity cost of labor or other resource is less than market values (This would be possible in a proprietorship whose owner considers his labor as fixed.),
- other personal and external financial factors exist, or
- there are expectations that revenues will shortly increase to cover variable expenses.

A more probable situation is the case in which Vc < R, but revenues are less than variable costs plus fixed, short-run cash overhead expenses (TCc). In this situation a plant would likely continue to operate as contributions are being made toward covering a portion of these fixed cash overhead expenses. The firm cannot operate indefinitely under this condition, but the length of this period is uncertain. Necessary to such a situation is the firm's expectation that revenues will increase to cover cash outlay. The conditions affecting closure decisions in such cases include:

- the extent of capital resources (If the owner has other business interests or debt sources that will supply capital input, the plant will continue.),
- there are not adequate cost accounting details or procedures to know that TCc > R (particularly in multiplant or business situation), or

- labor or other resources are considered fixed and the opportunity cost for these items is less than market value.

The identification of plants where $TCc > R$, but $Vc < R$ led to an estimate of plants that should eventually close if revenues do not increase. The timing of such closures, however, was too difficult to predict.

The next level of analysis, where $TCc < R$, involved estimating the earnings before and after investment in pollution abatement. Under conditions in which $TCc < R$, it seems likely that investment in pollution control will be made and that plant operations will continue so long as the capitalized value of earnings (CV) (at the firm's cost of capital) is greater than the scrap or salvage value (S) of the sunk plant investment. If $S > CV$, the firm could realize S in cash and reinvest and be financially better off. This presumes reinvesting at least at the firm's (industry's) cost of capital.

Computation of CV involved discounting the future earnings flow to present worth through the general discounting function:

$$V = \sum_{n=1}^{t} A_n(1+i)^{-n}$$

where

$V$ = present value

$A_n$ = a future value in $n^{th}$ year

$i$ = discount rate as target ROI rate

$n$ = number of conversion products, i.e., 1 year, 2 years, etc.

It should be noted that a more common measure of rate of return is the book rate, the rate which measures after-tax profits as a ratio of invested capital. These ratios should not be viewed as a different estimate of profitability as opposed to DCF measures (discounted cash flow); they reflect an entirely different profitability concept. The reader is cautioned not to compare the DCF rates directly with book rates. Although both measures are reported in the analyses, the book rate was reported for informational purposes only.

The two primary types of DCF measures of profitability were used. The first is the internal rate of return or yield, and it is the computed discount rate (yield) which produces a zero present value of the cash flow. The yield is the highest rate of interest the investor could pay if all funds were borrowed and the loan were returned from the cash proceeds of the investment. The second DCF measure is the net present value concept. Rather than solve for the yield, a discount rate equivalent to the firm's cost of capital was used. Independent investments with net present values of above zero were accepted; those below zero were rejected. The concept of comparing capitalized earnings with the sunk investment value is a variation of the net present value method.

The data input requirements for book and DCF measures were derived, to a large extent, from the same basic information although the final inputs were handled differently for each.

## 1. Profitability

In this analysis, profits for the book analysis were called after-tax income; for the DCF analysis they were called after-tax cash proceeds. The computation of each is shown below:

$$\text{After tax income} = (1 - T) \times (R - E - I - D)$$

$$\text{After tax cash proceeds} = (1 - T) \times (R - E - D) + D$$

where

$T$ = tax rate

$R$ = revenues

$E$ = expenses other than depreciation and interest

$I$ = interest expense

$D$ = depreciation charges

Interest was omitted in the cash proceeds computation since it is reflected in the discount rate, the after-tax cost of capital (see below). Depreciation was included in the DCF measure only in terms of its tax effect and it was then added back so that a cash flow over time was obtained.

A tax rate of 22 percent on the first $25,000 income and 48 percent on amounts over $25,000 was used throughout the analysis. Accelerated depreciation methods, investment credits, carry forward and carry back provisions were not used due to their complexity and special limitations.

The revenue, expense, interest and depreciation charges used were those discussed in Chapter II and Chapter V for pollution control facilities. These were assumed to be constant over the period of analysis.

## 2. Investment

Although investment is normally thought of as outlays for fixed assets and working capital, in evaluating the closure potentiality of an on-going plant where the basic investment is sunk, the value of that investment must be made in terms of its liquidation or salvage value, that is, in its opportunity cost or shadow price 1/. For purposes of this analysis, sunk investment was taken as the sum of fixed asset salvage value plus the value of the plant's net working capital (current assets less current liabilities, see Chapter II for values). This amount was taken as investment in year $t_0$ and as a negative investment in that year. Replacement investment for plant maintenance was considered to be equal to annual depreciation, a procedure which corresponds to the operating policies of some managements and which serves as a good proxy for replacement in an on-going business.

Investments in pollution control facilities were the estimates provided by EPA (see Chapter V). Only incremental values were used.

The above discussion refers primarily to the DCF analysis. Investment for estimating book rates was taken as invested capital, as the book value of assets plus net working capital.

## 3. Cost of Capital - After Tax

Return on invested capital is a fundamental notion in U.S. business. It provides both a measure of a firm's actual performance as well as its expected performance. In the latter case, it is also called the cost of capital. In this analysis the cost of capital was defined as the weighted average of the cost of each type of capital employed by the firm, generally its equities and interest bearing liabilities. There is no methodology that yields the precise cost of capital, but the cost can be approximated within reasonable bounds.

For the feedlot industry, no precise data were available for estimating equity costs. Accordingly, DPRA assumed a return on owners' investment of 8 percent, based on the estimated returns on investment for the various segments studied. The rate overstated the return for some segments and understated it for others.

Costs for long-term debt are assumed to be 7.5 percent. The after-tax cost of debt is 52 percent of the pre-tax cost (assuming a 48 percent tax rate). The after-tax cost used in this analysis is 3.9 percent.

The equity-debt structure was estimated at 60-40; the actual structure does not have great impact on the cost-of-capital.

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1/ This should not be confused with a simple buy-sell situation which merely involves a transfer of ownership from one firm to another. In this instance, the opportunity cost (shadow price) of the investment may be different.

The weighted cost of capital was estimated as follows:

|  | Percent of Investment | Cost | Weighted Cost |
|---|---|---|---|
| Equity | 60 | 8 | 4.80 |
| Debt | 40 | 3.9 | 1.56 |
| Weighted cost |  |  | 6.36 |

DPRA assumed a discount rate of 6.5 percent for the analysis.

### 4. Construction of the Cash Flow

The cash flow used in the analysis of effluent control was constructed as follows:

1. Sunk investment (salvage market value of fixed assets, plus net working capital) taken in year $t_0$, assumed to be equivalent to 1976.
2. After tax cash proceeds taken for years $t_1$ to $t_n$.
3. Annual replacement investment, equal to annual current depreciation taken for years $t_1$ to $t_n$.
4. Terminal value equal to sunk investment taken in year $t_n$.
5. Incremental pollution control investment taken in year $t_0$ for 1977 standards and year $t_6$ for 1983 standards.
6. Incremental pollution expenses taken for years $t_1$ to $t_n$ for 1977 standards and years $t_7$ to $t_n$ for 1983 standards, if additive to the 1977 standards.
7. Replacement investment taken in year $t_n$ on incremental pollution investment in BPT on assumption of life of facilities as provided by EPA.
8. Terminal value of pollution facilities to be taken in year $t_n$, equal to 50 percent of investment in lagoons and collection systems. Land value were assumed to be very small and/or zero.

The length of the cash flow was assumed to be 10 years (double the life of the equipment).

## B. Price Effects

At the outset, it must be recognized that price effects and production effects are synergistically interrelated (Figure IV-1). In fact, the very basis of price analysis is the premise that prices and supplies (production) are functionally related variables which are simultaneously resolved.

The determination of price effects requires a knowledge of demand growth, price and supply elasticities, the extent of regional market influence, the degree of large firm dominance in the industry, the market concentration of the industry's suppliers of inputs and purchasers of outputs, the organization of and coordination within the industry, the relationship between domestic output and the world market, the existence and nature of complementary goods, the industry's cyclical trends, the current utilization of the industry's capacity, and the effect of exogenous influences that bear upon price determination (e.g., governmental regulation).

In view of this complex diversity of factors involved in determining the market price, a purely quantitative approach to the problem of price effects was not feasible; hence, the simultaneous considerations suggested above were made. The judgment factor was heavily employed in determining the supply response to a price change and the alternative price changes to be employed.

In order to provide a standard which would reflect price effects, this study computed an estimated price sufficient to insure plant profit stability. The required price increase at the firm level was evaluated in light of the relationship of the model plant to the industry and to the competitive characteristic of the industry. The required price increase was computed by the described DCF analysis. It dealt only with incremental pollution investment and cash proceeds.

The application of the above DCF procedure to these costs yielded the present value of pollution control costs (i.e., investment plus operating cost less tax savings). Wherever this was known, the price increase required to pay for pollution control were calculated by the formula

$$X = \frac{(PVP)(100)}{(1-T)(PVR)}$$

where:

X = required percentage increase in price

PVP = present value of pollution control costs

PVR = present value of gross revenue starting in the year pollution control is imposed

The next step was to evaluate the required price increases against expectations regarding the ability to raise prices. As pointed out above, this was a function of several factors.

Livestock and poultry producers are price takers, not price-setters, and accordingly, they have little inherent capability for passing on price increases. Their prices will depend on changes in supply and demand relationships.

The impact of pollution control on production was evaluated to determine whether or not a decrease in supply and an accompanying price increase can be expected.

## C. Financial Effects

In Chapter II, the financial characteristics of model plants were presented. These data served as the base point for the analysis of the financial effects of pollution control. The primary focus of the analysis was upon profitability in the industry and the ability of the firms to secure external capital. Obvious, then, this portion of the analysis cannot be divorced from production effects since profit levels and a firm's ability to finance pollution abatement facilities will have a direct influence on supply responses--on utilization of capacity and plant closures.

To measure profitability the analysis employed after-tax book rate of return on invested capital and cash flow (after-tax profit plus depreciation) measurements. After-tax profit as a percent of sales was reported in order to compare financial data with standard industrial measures.

In addition, net present values were estimated by the procedures described in Section A above 1/. This measure was calculated on pre- and post-pollution control bases.

Given these financial measurements, the ability of the industry to finance the required pollution control expenditures was reexamined in light of the financial results and the information shown in Chapter II. The ability to do this varies from one industry subsector to another due to differential financial structures, profitability and abatement requirements; hence, capital availability and cost had to be examined on a model plant by model plant basis.

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1/ In the case of the broiler segment, pre-tax returns to family labor, management and investment were used in lieu of DCF analyses because of the difficulty in evaluating the opportunity cost of family labor and management.

## D. Production Effects

Potential production effects included changes in capacity utilization rates, plant closures, and the potentiality for a stagnation of industry growth. Feedlot closures may be offset in total or in part by increases in capacity utilization on the part of those remaining in operation. Expected new production facilities were estimated. The end result was an estimate of industry production under the conditions presumed for the above closure analysis.

The estimated production under these expectations was fedback into the price analysis to verify or revise expected price changes.

## E. Employment Effects

The production effects of production curtailments, plant closings and changes in industry growth affect industry employment. The employment effects stemming from each of these production impacts were estimated. To the extent possible, the major employee classifications involved were examined as was the potential for re-employment.

## F. Community Effects

Although the direct impacts of job losses upon a community are immediately apparent, in many cases, plant closures and cutbacks have a far greater impact than just that of an employment loss. Multiplier effects may result in even more unemployment. Badly needed taxes for vital community services may dwindle. Community pride and spirit may be dampened. However, in some cases, such negative community impacts may be short-term and relatively minor within the overall community. In a few cases, the closure of a plant may actually be viewed as a positive net community effect (e.g., a small plant with a high effluent load in an area with a labor shortage).

These impact factors were qualitatively analyzed.

## G. Other Effects

Other impacts such as direct balance of payments effects were also qualitatively analyzed.

# V. COST OF POLLUTION CONTROL

The cost of pollution control was analyzed by first evaluating the state-of-art relative to existing pollution controls in each type of feedlot. Feedlot segments which had existing effluent controls adequate to meet pending standards and those which did not need controls were dropped from further analysis. Investment and annual operating costs for effluent controls were thus estimated for feedlot segments not meeting the effluent guidelines.

## A. State-of-Art in Pollution Control

### 1. Broiler Industry

All commercial broilers are grown in totally confined production systems. Throughout their life cycle, broilers are held in houses which protect them from precipitation and extreme climate conditions. Excretions are dropped on dry litter which effectively absorbs excess moisture. Basically, broilers are grown in a dry environment.

Litter is removed from the houses frequently and spread on fields in a semi-dry form and turned under as fertilizer. No effluent problems need occur under this system, but two possible problems can arise that would require changes in litter handling. (1) If the litter is not sheltered adequately, run-off could occur. (2) If the litter is applied to the land regardless of the land's ability to absorb the nutrients, an excessive application can cause run-off problems affecting water quality in nearby streams. Both of these situations can be corrected through proper management supervision and should require minor incremental investment and operating costs.

Except for these potential problems, the broiler segment does not appear to require effluent controls.

### 2. Turkey Industry

Turkeys are grown in either a totally housed system or on an open range. Poults are initially sheltered for about eight weeks. During this time, turkeys are held in a dry environment. Their excretion is deposited on dry litter (and passes the potential run-off problems discussed above).

At about eight weeks of age, poults are placed on open ranges in the large operations considered in this study. Birds so placed are stocked at a limited density rate and the ranges are rotated from one brood to another. Though the procedure is used primarily for disease control, it also effectively prevents the build-up of excretions.

As ranges are rotated and excretions become scattered over a broad area, we assume that run-off lagoons are required. Where practical, a single lagoon could serve two or more range areas, or each range may require a separate lagoon. The waste is disposed of by a traveling gun system.

### 3. Egg Industry

As with broilers, large laying flocks are held in confinement either on floor or in cage systems. In both systems, birds are protected from precipitation and held in a relatively dry environment. Excretions are either dropped on dry litter or on concrete floors and are removed at frequent intervals and spread on fields in a semi-dry condition. They are then turned under for fertilizer or washed into lagoons. The latter is a relatively new management system that presents conditions similar to those on turkey ranges.

Egg producers, apparently meet state and local requirements and since no federal controls now exist for non-point source control, we assume that this segment meets federal standards.

### 4. Sheep Industry

Two management systems prevail in the handling of sheep breeding stock. In the western half of the U.S., where 80 percent of the breeding stock is located, sheep are held on large ranches which may involve thousands of acres. In the eastern half of the U.S., small farm flocks predominate. In both cases, sheep are held in pastures with limited density. Effluent discharges are widely scattered and result in limited, if any, effluent pollution problems.

Little information is available relative to lamb and sheep feeding in feedlots. After discussions with industry personnel and staff members of EPA, DPRA assumed that large feedlots, over 1,000 head per year, presently meet proposed effluent guidelines.

### 5. Duck Industry

Currently about 90 percent of the production of ducks is concentrated in five states. Two production systems are used -- wet and dry lots.

Ducks produced on dry lots have no access to water other than for drinking purposes. Wastes are predominately deposited on litter inside houses, and since no effluent problems are evident, this system is assumed to meet effluent guidelines.

Ducks produced in wet lot systems use a dry lot that also offers access to water for the swimming which is necessary for particular types of feather development. These operations are currently expected to meet 1977 standards, but they require additional investments to meet zero discharge by 1983. The lack of necessary data and the fact that there is no indication that the imposition of the 1983 standards will have a significant impact on the industry, impact analysis and further discussion was eliminated.

### 6. Fed Cattle Industry

Nearly all fed cattle sold for commercial slaughter are fed in open lots. A limited number of feeders employ totally confined systems.

In open lot systems, cattle are held in high density lots with about 200 square feet of space per animal. Depending upon the region of the U.S. and the size of feedlots, shelters may be provided. Farmer feeders in the Midwest normally provide shelter; on large feedlots in the West the cattle are exposed to all precipitation.

Feedlots are usually constructed on sloping land, and on flat land, lots are mounded to provide sloping. The sloping facilitates the disposal of liquid wastes from animals and precipitation.

The technology used in disposing of liquid and dry manure varies greatly from one feedlot to another and by size segment. Generally, all feedlots follow similar practices for disposing of solid wastes while considerable variation exists in handling liquid runoff.

Normally solid wastes are removed from lots and deposited on fields as fertilizer. In some operations, solids may be stockpiled prior to distribution and can, thus, create a potential pollution problem. Disposal of liquids varies from collection systems using holding basins or lagoons to allowing liquid effluents to runoff directly into streams. EPA indicates that 60-70 percent of all lots with 1,000 or more head capacity meet effluent guidelines of zero discharge.

### 7. Hog Industry

Three different types of management systems prevail in hog production: (1) open-lot-pasture; (2) concrete penning with full or partial roofing; and (3) full confinement. Since about 60 percent of large operations are open-lot systems, DPRA's model reflects the open-lot system.

In open-lot systems hogs are held on dirt or pasture with but limited shelter. Density rates vary from 10 to over 100 hogs per acre. All excretions are normally left on the land and are subject to effluent runoff. The EPA estimates that only 5 to 10 percent of all producers with open lot systems meet proposed effluent guidelines.

Producers feeding hogs on concrete with pens partially or fully protected, use different levels of technology for manure disposal than do open lot producers. Solid wastes are scraped or "flushed out" with water. Either method necessitates waste removal and spreading on fields or the use of

Table V-1. Estimated current effluent control status, feedlot industry

| | Meet Proposed Effluent Guidelines | Percent Meeting Effluent Guidelines |
|---|---|---|
| Broilers | Yes | 100 |
| Layers | Yes | 100 |
| Sheep | Yes | 100 |
| Ducks | */ | */ |
| Beef (1,000 head or more) | No | 60-70 |
| Swine | | |
| Dirt/open lot | No | 5-10 |
| Concrete/open lot | No | 75-80 |
| Totally confined | Yes | 100 |
| Dairy (dry lot) | No | 60-70 |
| Cow yards | No | 60-70 |
| Turkeys | No | Unknown |

*/ Lack of available data necessitated eliminating ducks from impact analysis.

holding basins or lagoons to prevent effluent runoff. Liquid waste is controlled through lagoons or holding basins, and the latter basins necessitate the disposal of liquids on fields. It is estimated that 75-80 percent of all producers using this management system meet effluent runoff standards.

Producing hogs in full confinement systems is a relatively new technology and is employed by about 40 percent of the large producers who it is assumed, have met effluent runoff standards. No impact analysis will be performed on the confined operations.

### 8. Dairy Industry

The management systems used in handling dairy cows involves two basic technologies: (1) full confinement during winter months with cows on pasture during grazing periods; and (2) open lot systems with cows held in confinement. The former practice prevails in the North and Northeast, and the latter, in the South, Southwest and West.

Manure disposal technologies for systems involving full confinement with summer pasture require spreading solid wastes from barns and controlling the effluent runoff from holding areas adjacent to barns and from the water used to clean milking equipment and parlors. The EPA estimates 60-70 percent of the operations with 100 to 200 cows presently meet effluent guidelines.

The open lot technology required for manure disposal is similar to that for confinement-pasture systems with the exception of increased requirements for controlling effluent discharges. In open lots, all excretions are exposed to precipitation. An estimated 60-70 of all these production units meet effluent guidelines.

Available data indicate and EPA staff members generally conclude that the layer, sheep, and duck industries already meet control requirements. The remaining four industry segments -- beef, hogs, dairy, and turkeys -- were assumed to need additional investment to control effluent runoff.

## B. Incremental Costs of Pollution Control

The basic data used to estimate the investment and operating costs for pollution control were provided by the Environmental Protection Agency. Incremental costs for each model feedlot were based upon these EPA estimates.

Investment costs are minimal, since no land or equipment for the removal of solid wastes have been included. The costs assume that the operator has adequate and sufficient land and equipment. Where these conditions do not prevail, investment costs would be higher.

Annual operating costs for pollution control were also estimated by EPA.

### Operations and Maintenance

| | |
|---|---|
| Lagoons | 5 percent of investment |
| Equipment | 10 percent of investment |

### Depreciation

| | |
|---|---|
| Lagoons | 5 percent (20-year life) |
| Equipment | 20 percent (5-year life) |

In addition to these, DPRA added an annual interest expense for the incremental investment, using a rate of 7.5 percent on one-half of the original cost. The assumption was that the loan value of the investment declined on a straight line basis, and resulted in lower interest charges each year. Using half-value approximated the average annual interest over the life of the asset.

The effluent control systems assumed for each segment are shown in Table V-2.

### 1. Investment Costs

Table V-3 summarizes the estimated investment costs for the effluent control systems for each model feedlot. These values were derived from cost estimates furnished by the Environmental Protection Agency.

The systems for each representative feedlot are essentially the same -- a lagoon (or holding basin), a collection system which includes clean water diversion and run-off collection and settling basins, and a disposal system for distributing liquid waste in the fields. All feedlots, except the three largest beef cattle operations, are assumed to use a traveling gun for liquid waste distribution. The large beef cattle models (5,000 head capacity and larger) are assumed to use a center pivot sprinkler system rather than the traveling gun.

An important comparison is the relationship of effluent control investment costs to base investment. Table V-3, in the right hand column, shows the effluent control investment as a percentage of the base investment (replacement value of fixed assets only). These percentages were relatively minor for all segments with the exception of the 1,000 head of beef cattle feedlot. It should be noted, however, that for older hog and dairy facilities, incremental investment for effluent controls represented a significant percentage of original cost or of book value.

Table V-2. Effluent control systems by industry segments.

| Segment and Size | Lagoon | Pump | Traveling Gun | Center Pivot |
|---|---|---|---|---|
| **Beef** | | | | |
| 1,000 | X | | X | |
| 5,000 | X | | | X |
| 10,000 | X | | | X |
| 20,000 | X | | | X |
| **Swine** | | | | |
| 2,500 | X | | X | |
| **Dairy** | | | | |
| 700 (Southwest & West) | X | | X | |
| 1,000 | X | | X | |
| 700 (South) | X | | X | |
| 1,000 | X | | X | |
| **Turkeys** | | | | |
| 55,000 | X | | X | |
| 100,000 | X | | X | |

Table V-3. Investment costs for effluent control by segment.

| | | Lagoon Investment [1/] | Collection System [2/] | Disposal Equipment [3/] | Total Cost | Precent of Base Investment |
|---|---|---|---|---|---|---|
| | | | | | | (%) |
| **Fed Cattle** | 1,000 | $2,160 | $1,520 | $7,410 | $11,090 | 14 |
| | 5,000 | 8,800 | 6,320 | 15,600 | 30,720 | 10 |
| | 10,000 | 16,960 | 12,320 | 23,200 | 52,480 | 9 |
| | 20,000 | 32,680 | 24,320 | 37,600 | 94,600 | 9 |
| **Hogs** | 2,500 | 1,500 | 1,070 | 7,580 | 10,150 | 5 |
| **Dairying** | 700 | 3,170 | 1,110 | 8,340 | 12,620 | 2 |
| **(Southwest & West)** | 1,000 | 4,170 | 1,450 | 9,060 | 14,680 | 2 |
| **Dairying** | 700 | 6,680 | 1,895 | 11,880 | 20,455 | 4 |
| **(South)** | 1,000 | 9,560 | 2,570 | 14,080 | 26,210 | 3 |
| **Turkeys** | 55,000 | 2,090 | 1,315 | 8,040 | 11,445 | 4 |
| | 100,000 | 3,810 | 2,390 | 14,620 | 20,820 | 4 |

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[1/] Includes fencing.

[2/] Includes clean water diversion, run-off collection and settling basin.

[3/] Liquid waste disposal only. Units were assumed to have equipment for solid waste disposal.

[4/] Effluent control investment original cost divided by base investment replacement value of fixed assets only.

One further qualification regarding investment should be made. Land costs for lagoons and collection systems were not included in the incremental investment figures. The assumption was made that operators hold sufficient land to construct the lagoons and collection systems. The acres needed to construct cattle feedlot lagoons were estimated as follows:

| Size | No. Acres |
|---|---|
| 1,000 | 1.4 |
| 5,000 | 3.7 |
| 10,000 | 7.0 |
| 20,000 | 10.1 |

Assuming that the collection system requires approximately the same acreage as that required for the lagoon construction, the diverted acres would amount to about 20 acres for the largest (20,000 head) operation. The assumption is reasonable that this quantity of land is readily available. No opportunity cost for diverted land was considered. If the operators must buy additional land, investment costs for pollution control could be 10 to 15 percent higher (assuming land costs of $500 per acre).

### 2. Annual Incremental Operating Costs

The incremental annual expense for operating pollution controls were estimated and are summarized in Table V-4. The right-hand column shows these added costs as a percent of base total costs. Only for the hog feedlot did the increase amount to as much as one percent of the base total costs. For hogs, the increase was 1.4 percent; thus, the incremental costs, as estimated here, are relatively insignificant in relationship to base costs.

Table V-4. Incremental costs for operating effluent control by segment.

| | | O & M | | Depreciation | | | | | Percent |
|---|---|---|---|---|---|---|---|---|---|
| | | Lagoons | Equipment | Lagoons | Equipment | Collection | Interest | Total Costs | of Base Costs (%) |
| Fed Cattle | $ 1,000 | $ 108 | $ 741 | $ 108 | $1,482 | $ 76 | $ 416 | $ 2,931 | <1 |
| | 5,000 | 440 | 1,560 | 440 | 3,120 | 316 | 1,152 | 7,028 | <1 |
| | 10,000 | 848 | 2,320 | 848 | 4,640 | 616 | 1,968 | 11,240 | <1 |
| | 20,000 | 1,634 | 3,760 | 1,634 | 7,520 | 1,216 | 3,548 | 19,272 | <1 |
| Hogs | 2,500 | 75 | 758 | 75 | 1,516 | 54 | 381 | 2,859 | 1.4 |
| Dairying | 700 | 159 | 834 | 159 | 1,668 | 56 | 473 | 3,349 | <1 |
| (Southwest & West) | 1,000 | 209 | 906 | 209 | 1,812 | 73 | 551 | 3,760 | <1 |
| Dairying | 700 | 334 | 1,188 | 334 | 2,376 | 95 | 767 | 5,094 | <1 |
| (South) | 1,000 | 478 | 1,408 | 478 | 2,816 | 129 | 983 | 6,292 | |
| Turkeys | 55,000 | 105 | 804 | 105 | 1,608 | 66 | 429 | 3,117 | <1 |
| | 100,000 | 191 | 1,462 | 191 | 2,924 | 120 | 781 | 5,669 | <1 |

# VI. IMPACT ANALYSIS

The imposition of effluent controls on the "large scale" feedlots industry will likely cause adjustments within the feedlot industry. The impact on each of the eight feedlot segments will vary, and as will be discussed below, the industry adjustments will largely be structural changes. Four of the eight feedlot segments were eliminated from the impact analysis because they either do not have effluent discharge problems or, for the most part, currently do meet proposed effluent guidelines with inplace control facilities or management practices. Thus, imposition of the control standards would not represent an incremental impact on these segments.

Those industry segments eliminated from the impact analysis were:

1. Broiler
2. Eggs
3. Duck
4. Sheep

The remaining industry segments, those potentially impacted by the establishment of effluent control guidelines are:

1. Beef
2. Swine
3. Dairy
4. Turkey

Even within these four segments, some producers are considered currently either to meet pending effluent guidelines or not to have effluent control problems. Table VI-1 shows the estimates of the percentages of segments that currently do not meet effluent guidelines. An estimated 60 to 70 percent of beef feedlots with capacities greater than 1,000 head (commercial feeders) currently meet the proposed guidelines. Seventy to seventy-five percent of all large hog operations (capacities of 2,500 head and over) are thought to meet the effluent guidelines. Free barn or cow yard operations meeting pending effluent guidelines are estimated at 60 to 70 percent for those producers having 700 head or more. All large turkey farms are assumed to be open lot operations not currently having effluent control facilities. The magnitude of the impact of pollution control standards on these segments will be moderated by the existence of adequate waste management and control facilities.

The impacts on these four industries were analyzed by industry segment and by size within segments where appropriate. The impacts considered in this analysis included the following:

Table VI-1. Estimated percentages of those feedlots which do not meet pending effluent guidelines

| Segment & Size | Technology | Percent Not Meeting Proposed Guidelines |
|---|---|---|
| **Beef** | | |
| 1,000 capacity | Open dirt lot | 30-40 |
| 5,000 " | " | 20-30 |
| 10,000 " | " | 20-30 |
| 20,000 " | " | 10 |
| **Swine** | | |
| 2,500 capacity | Concrete lot/partial shelter/ total confinement | 20-25 |
| **Dairy** | | |
| 700 on hand | Cow Yard | 30-40 |
| 1,000 " | " | " |
| **Turkey** | | |
| 50,000 capacity | Open lot | 100 |

Source: Communications from the Environmental Protection Agency.

A. Price effects
B. Financial effects
C. Production effects
D. Employment effects
E. Community effects

A comprehensive and quantitative impact analysis was concluded to be beyond the scope and data of this study. The impact analysis was based on the broad but limited data available and on general theoretical economic concepts. The objective of the analyses was to obtain qualitative inferences and the conclusions are, thus, stated in terms of the direction and degree of impacts.

## A. Price Effects

Assessing the price effects resulting from mandatory pollution abatement standards involved exploring both long and short run demand and supply considerations in order to determine what changes in market clearing (equilibrium) prices and quantities will likely occur. This resulted from investigating (1) the price changes required to maintain existing profit levels for the various industry segments, (2) the probable short run price effects and (3) the expected long run price adjustments.

The determination of price impacts resulting from the imposition of effluent controls on the large scale segments of the feedlots industry also included a consideration of possible controls on small feeders. Since the nature of controls on small feeders has not been established, it was necessary to make certain assumptions about the impact of such effluent controls. The following price impact analysis, therefore, should be considered as tentative, pending a determination of the guidelines for the small feeders.

### 1. Required Price Changes

The price increases required to compensate feedlot producers for the additional costs incurred by pollution abatement standards are expected to be relatively small for the four feedlot industry segments. Table VI-2 shows the price increases necessary to maintain current profit levels. These estimates were based on the model feedlot analysis presented in Chapter II. Some additional results of this analysis are presented in Table VI-3, which shows the effluent control costs per hundredweight of product for the model firms. Due to the method of computing required price increases, they are not equal to the unit cost figures calculated

Table VI-2. Required price increase to maintain industry profitability with effluent controls

| Segment | Size | Price Increase | |
|---|---|---|---|
| | (Head) | $/cwt. | (%) |
| Fed cattle | 1,000 | 0.155 | 0.48 |
| | 5,000 | 0.07 | 0.22 |
| | 10,000 | 0.065 | 0.20 |
| | 20,000 | 0.06 | 0.18 |
| Hogs | 2,500 | 0.28 | 1.38 |
| Dairying (Southwest and West) | 700 | 0.03 | 0.48 |
| | 1,000 | 0.027 | 0.44 |
| Dairying (South) | 700 | 0.05 | 0.80 |
| | 1,000 | 0.047 | 0.76 |
| Turkeys | 55,000 | 0.17 | 0.74 |
| | 100,000 | 0.16 | 0.71 |

Table VI-3. Estimated investment cost and annual operating cost of effluent controls per hundredweight of throughput

| Segment | Size | Annual throughput | Effluent Controls | |
|---|---|---|---|---|
| | | | Investment | Annual Costs |
| | (Head) | (Hundredweight) | (¢ per cwt.) | |
| Fed cattle | 1,000 | 20,526 | 54.0 | 14.3 |
| | 5,000 | 102,628 | 29.9 | 6.8 |
| | 10,000 | 205,255 | 25.6 | 5.5 |
| | 20,000 | 410,510 | 23.0 | 4.7 |
| Hogs | 2,500 | 11,250 | 90.2 | 25.4 |
| Dairying (Southwest & West) | 700 | 91,000 | 13.9 | 3.7 |
| | 1,000 | 130,000 | 11.3 | 2.9 |
| Dairying (South) | 700 | 91,000 | 22.5 | 5.6 |
| | 1,000 | 130,000 | 20.2 | 4.8 |
| Turkeys | 55,000 | 19,800 | 57.8 | 15.7 |
| | 100,000 | 36,000 | 57.8 | 15.7 |

for model plants (see Chapter II).[1] It should be noted that there is variation both among and within individual segments. Certain size segments will require higher price increases than others. For example, beef producers show a required price increase ranging from $.155 per hundredweight for open lots marketing 1,000 cattle per year to $.06 per hundredweight for the largest feedlot model (20,000 head capacity marketing 43,200 head annually). Dairy producers require a price increase of from $.027 per hundredweight to $.05 per hundredweight.

The above price increases are estimates of those required to maintain existing profit levels for feedlot operations of various sizes. Producers will be unlikely to realize fully their required price increases. If a uniform price increase occurs for each product, (as would be expected in a competitive market) a change from existing profit levels is implied for some producers, most notably, those in the beef industry. A discussion of probable short and long run price impacts follows.

### 2. Short Run Price Impacts

The short run price effects resulting from pollution abatement standards were determined by the nature of the demand for the industry's product and by its impact on industry capacity and utilization rates (i.e., its output).

In general, individual production units within the feedlot industry are price takers in a competitive market. If the demand for the industry's product is highly inelastic, as is generally thought, then price increases will be relatively large and may nearly cover the pollution control costs of the impacted producers who continue production. In this case, relatively few producers would be expected to stop production, and the short run decline in industry output would be relatively small. Only a small portion of pollution control costs would be absorbed by the profits of the impacted firms, for most firms would pass these costs through to consumers. It should be noted, however, that to the extent that the existing product demand is more elastic, price rises will be smaller, more producers will exit the industry, and a greater portion of pollution control costs will be borne by the profits of the remaining impacted producers.

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[1] Price increases required per hundredweight is based on the ratio between total cost incurred by impacted feedlots and the total production of both impacted and non-impacted feedlots. As the price cannot be increased for only impacted feedlots production, the cost per hundredweight for the same feedlots is less than the increases required to cover costs based on total production.

The particular effects on industry capacity and utilization (hence, on output and prices), will depend upon the time at which the proposed pollution abatement standards are applied. An immediate imposition of effluent control standards could result in a rapid and sizeable (though probably temporary) contraction of industry capacity as significant numbers of production units decide they cannot comply quickly with standards and cover operating and/or opportunity costs. If the effluent controls are complied with gradually over the next four years, price increases would be less marked than under immediate controls. Gradual compliance among large-scale producers appears to be the present trend, however, the same is not true for small scale operators. The exit from the industry of feedlot operations that become unprofitable would be gradual, and, given more time to adjust, fewer. During that time, industry output may be partially or wholly restored by producers who increase capacity and/or utilization rates.

As discussed earlier, data indicate that many major producers currently meet proposed effluent guidelines. On the assumption that similar standards are applied to the smaller producers in the feedlots industry, an estimated 50 percent of fed cattle, 75 percent of swine, 50 percent of dairy products, and 70 percent of turkeys come from operations that would be impacted by required effluent controls. Given the gradual compliance to these controls by 1977, the reduction of each industry's supply (i.e., a shift of the industry's supply curve) would be moderate; consequently, product price increases would also be moderate and the exit of production units, commensurate. Impacted firms will absorb a portion of the pollution control costs, and profits will be significantly redistributed from impacted to non-impacted firms. Furthermore, if the essential price increases within segments are approximately similar to those suggested earlier, the actual price increases will be moderate also.

In one respect, the effect of effluent control standards may be viewed as an acceleration of a basic industry trend -- the closing of relatively inefficient production units, the majority of which appear to be the smaller producers in the large scale segments. The partial absorption of pollution control costs with its resulting reduction of profits will, in the short run, make net unprofitability apparent sooner, hasten their exit from the industry and reduce industry numbers. In the long run, too, as is explained in the next section, effluent control impacts will reduce industry firm numbers.

The above is a general assessment of the factors determining short run price effects for the feedlot industry as a whole. A specific segment evaluation of market situations and short run price impacts is presented below.

Traditionally, beef producers, lacking marketing cooperatives and functioning within a competitive market, have little marketing power; consequently, the industry's marketing characteristics will not encourage cost pass through. Although only an estimated 30 to 40 percent of the commercial feeders (those with 1,000 head capacity or greater) will require additional costs for effluent controls, fully 19 to 25 percent of the 1972 fed cattle would be so affected. Both the industry's marketing characteristics and the numbers of cattle affected suggest that, in the short run, the price rise for fed beef will be moderate and that a portion of pollution control costs will be borne by the impacted producers who continue production.

Like the beef feedlot operators, hog producers are price-takers who have no strong marketing cooperatives through which they can influence the hog market. It is estimated that 25 percent of the large hog producers (those having capacity of 2,500 hogs or more) will require additional investment in order to meet proposed effluent control standards. Too, if effluent control standards for smaller producers are also required, an estimated 90 percent of such producers handling an estimated 75 percent of all hogs will be impacted, a condition which implies that price increases in this industry segment will be relatively large. The price rise should very nearly cover the cost of the pollution controls incurred by the large producers.

The dairy producer is in a highly favorable position. Their marketing cooperatives can negotiate milk prices with the milk processors and an estimated 60-70 percent of the larger dairy producers (those with herds of 700 or more, using predominately the open lot method) currently meet proposed effluent control standards. Most dairy production is accounted for by smaller production units which will not be impacted by the effluent standards. This suggests that realized price rises for dairy products will be moderate and that pollution control costs will be absorbed, in part, by the profits of the impacted large producers. The estimated price increase "requirements", however, suggest that these price increases will not be large.

Since most open lot turkey feedlots are assumed to lack sufficient effluent control facilities, a preponderance of producers will be impacted. The consequent marginal reductions in output and the possible exit of some producers will probably allow the remaining large producers to cover their pollution control costs with price increases.

The secondary price effects of effluent controls are, in the short run, expected to be insignificant, for only a very small increase in the retail price of beef, swine, or milk is expected as a result of pollution controls. Not all feedlots will be affected by effluent controls; thus, industry cost increases as a whole will not be large and consequent price increases in these competitive markets will be moderate. Too, consumer purchase units (pounds and half pounds) are small enough that the price increase per consumer unit will be minor.

### 3. Long Run Price Effects

The long run price effect of pollution controls for the feedlot industry will be higher prices and a smaller quantity produced than would otherwise have been the case. Since the costs associated with effluent controls in this industry are mostly fixed costs, general economic theory clearly suggests that fewer production units will remain in the industry and that the remaining producers will increase their output (via increased capacity or slightly greater utilization of existing capacity). The reduced total industry production will result from the loss of some relatively inefficient producers. (The feedlot industry consists of production units of various sizes operating at different levels of output and using somewhat different technologies. With the possible exception of that for the high industry segment, data suggest that the larger production units have realized reduced costs per unit of product; consequently, those exiting the industry are mainly smaller producers.)

Although producers within and among industry segments realize different levels of profits, the industry is basically competitive and industry profits at any given time are normally not "excessive"; thus, in the long run, little if any of pollution control costs can be absorbed by industry profits. Ultimately, the consumer can be expected to pay most of the costs of pollution control through higher product prices. There will be, however, a redistribution of profits from the impacted to the non-impacted producers.

It must be realized that the above effects of imposing pollution controls will simultaneously occur and that a great many other factors will affect industry long run supply and demand. The continual exodus of small, inefficient producers, the increased market share supplied by low cost producers, veterinary technology advances and improved breeding and feeding environments all tend to result in greater supplies and lower prices. On the other hand, rising farm labor costs and higher prices for feed grain have an off-setting influence. Although the net effect of such forces cannot presently be accurately determined clearly, it will be difficult to assess the direct and long run effects of pollution abatement costs since they will likely be small in comparison to the effects of other factors. Nevertheless, the imposition of pollution control standards will cause prices, output, and industry structure to be different, in the manner suggested by the previous discussion, than they otherwise would have been.

## B. Financial Effects

### 1. Profitability

The impact of pollution controls on the profitability of the various segments of the feedlot industry is reported in Tables VI-4 and VI-5.

Table VI-4. Estimated cash proceeds and net present values of model feedlots without and with effluent controls

| Segment | Size | Base |  | With P.C. |  |
|---|---|---|---|---|---|
|  |  | Cash flow [1] | NPV | Cash flow [1] | NPV |
| Fed cattle | 1,000 | 17 | 50 | 16 | 37 |
|  | 5,000 | 64 | 153 | 65 | 133 |
|  | 10,000 | 145 | 444 | 146 | 408 |
|  | 20,000 | 312 | 1,067 | 314 | 1,003 |
| Hogs | 2,500 | 28 | 96 | 28 | 84 |
| Dairying (Southwest & West) | 700 | 39 | 125 | 39 | 111 |
|  | 1,000 | 64 | 250 | 64 | 233 |
| Dairying | 700 | 39 | 125 | 39 | 101 |
|  | 1,000 | 64 | 250 | 64 | 221 |
| Turkeys | 55,000 | 26 | 49 | 26 | 36 |
|  | 100,000 | 48 | 91 | 48 | 69 |

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[1] Cash flow derived by excluding interest from after-tax income computation. Will differ from cash flow reported in Table VI-5.

Table VI-5. Comparison of after-tax return on investment and cash flow before and after pollution control

| Segments | Size | After-tax profit |  |  | After-tax ROI |  |  | Cash flow |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  | Pre | Post | % change | Pre | Post | % change | Pre | Post | % change |
|  |  | $000 |  |  |  |  |  |  |  |  |
| Fed cattle | 1,000 | 14 | 11 | -27 | 10 | 7 | -30 | 16 | 15 | -6 |
|  | 5,000 | 54 | 51 | - 6 | 9 | 8 | -11 | 63 | 64 | +2 |
|  | 10,000 | 126 | 120 | - 5 | 10 | 9 | -10 | 143 | 143 | 0 |
|  | 20,000 | 275 | 265 | - 4 | 11 | <11 | <0 | 306 | 306 | 0 |
| Hogs | 2,500 | 15 | 12 | -20 | 11 | 8 | -27 | 24 | 23 | -4 |
| Dairying (Southwest & West) | 700 | 25 | 23 | - 8 | 5 | <5 | <0 | 30 | 30 | 0 |
|  | 1,000 | 47 | 45 | - 4 | 7 | <7 | <0 | 53 | 53 | 0 |
| Dairying (South) | 700 | 25 | 22 | -12 | 5 | <5 | <0 | 31 | 30 | -3 |
|  | 1,000 | 47 | 44 | - 6 | 7 | 6 | -14 | 53 | 53 | 0 |
| Turkeys | 55 | 7 | 3 | -57 | 4 | 2 | -50 | 22 | 20 | -9 |
|  | 100 | 13 | 8 | -38 | 4 | 2 | -50 | 40 | 39 | -3 |

Table VI-4 presents after-tax cash proceeds and net present values for each model feedlot before and after the imposition of controls. The cash proceeds (after-tax proceeds plus depreciation) for each model remain remarkably constant because the depreciation on pollution investment offsets the decreased earnings due to the addition of pollution control operating costs.

Net present values decline for all of the models after the imposition of controls, but the values remain substantially above zero. On the basis of this analysis, profitability declines for each segment, but the new levels of profitability are high enough to continue existing operations.

Table VI-5 compares the estimated after-tax incomes, cash flows, and returns on investment before and after pollution control. Here the impacts, expressed in conventional accounting terminology, are more dramatic for several of the representative model operations. The decrease in after-tax profits is substantial for the 1,000-head cattle, the 2,500-head hog, the 700-head dairy (Southern) and both turkey feedlots. The turkey growers are the most severely impacted, with profit declines of 57 and 38 percent.

The returns on investment show similar changes with decreases ranging from negligible for four of the model feedlots up to 50 percent for the turkey growers. The hog operation and the 1,000-head cattle feedlot experience 27 and 30 percent declines.

Cash flows are basically not affected by pollution controls. With depreciation on pollution control investment offsetting the decline in profits, the decreases in cash flow are limited to a range of $1,000 to $2,000.

Since actual feedlot operations vary from the models, some operators will undoubtedly suffer more severe impacts. Those operators who are less efficient than the model plants will initially earn lower returns and may find themselves in a negative condition ($TC_c > R$) after installing pollution controls. This is especially true of turkey growers. The eventual impact on industry profitability depends, in part, upon the degree to which pollution control technologies are already in place. The estimates presented earlier argue that most large operators meet the standards.

## C. Production Effects

The logic of the feedlot industry structure indicates that feedlot product prices and production are interactive. DPRA's discussion of the effect of pollution controls on product prices, consequently, reflected also the production rates and industry product percentages of each impacted segment. Those ratios are implied in the following discussion of the effect of pollution controls on large feedlot industry production. DPRA assumed, also, that similar control standards will affect small producers and that their subsequent production effects will, in part, determine large producer effects.

As the discussion of the financial effects indicated, the profitability of large producers in all four industry segments would not be decreased significantly even if no effluent control costs were passed on in price increases. Similarly, DPRA concluded that the imposition of the EPA's controls will not force any large producer to cease production 1/.

Any change in the production of large producers will result from marginal output adjustments.

The assumption that most (e.g., 75 percent) effluent control costs are fixed implies a very slight decrease in production for each large producer, for general economic theory argues that producers always adjust output so as to maximize profits. (This is before any change in the product price has occurred, however.)

Similar economic impact studies show that small producers are the most severely impacted firms in an industry. This fact and relevant feedlot industry data together showed that as small producers cease operations, the industry will experience a significant short-run decline in production. Product prices will subsequently rise "moderately" and will, (see "Price Effects") in turn, induce profit-maximizing large producers to increase output. Although the extent of these production increases will depend upon the exact nature of the large producers' costs and upon the ultimate size of price increases, large producers can be expected to produce more than they did before the imposition of effluent control standards. Total industry production will, however, be less because fewer small producers will remain in the industry.

The number of large producers may increase slightly, for product price increases may induce some medium-sized producers to increase their capacity and output.

In general, then, though the data available for this study precluded DPRA's making definitive and quantifiable projections of future industry production and though the interaction of supply and demand forces is highly complex in this industry, the general trend is obvious: the output of large production units will be somewhat greater and the number of large producers marginally greater than without effluent controls.

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1/ This conclusion is based upon DPRA's economic analysis. It should be noted that there may be isolated cases where a feedlot does not have sufficient land available for ponds and land disposal of the effluent and that the imposition of these control standards may force closure. However, the data base is insufficient to estimate the number of feedlots falling into this condition. In general, it is believed that the number is negligible.

## D. Employment Effects

Assuming that no substantial changes in technology are precipitated by the imposition of effluent controls, changes in employment will depend on changes in the number of producers and the level of production. It was indicated that no large producers are expected to stop production; that, in the short run, a slight decrease in output is expected from large producers; and that, in the long run, output will be somewhat greater than before controls. Correspondingly, DPRA projected an initial decrease in employment by large producers, followed by a slight increase. When compared to the current employment by large producers, these adjustments will be negligible. A potentially significant employment reduction among smaller producers can be anticipated as these firms are forced to close.

## E. Community Effects

DPRA concluded that effluent controls applied to large producers will cause little economic impact on local communities. The long run impacts on local economies traceable to slightly increased revenues for large producers (this assumes an inelastic market demand for their product) and the increase in their purchases of material inputs will be slight.

The community effects in regions dominated by smaller production units will be different and more significant. In such areas, some decrease in the number of active producers will result in lower employment and in the purchases of material inputs.

## VII. LIMITS OF THE ANALYSIS

This analysis of the economic impact of effluent controls on the feedlot industry utilized data from both industry and published secondary sources plus industry sources. The accuracy of the analysis' conclusions, generalizations and impact assessments depended upon the availability and quality of input data and, consequently, varied by industry segment.

The purpose of this chapter is to identify the limitations of the analysis inherent in the data sources and methodology. These will be discussed in terms of general accuracy, range of variation, critical assumptions, and remaining questions.

### A. General Accuracy

Data on the number of feedlots in each segment by size of operation came essentially from the Census of Agriculture and other USDA publications. For fed cattle, statistics were available to permit quite accurate classifications. For the other segments, however, the identification of large producers above the cut-off size for this report became extremely difficult. For example, for dairy herds, no data were available to indicate the number of units larger than 200 head. For hogs, the largest break point in Census data was 1,000 head marketed. These categories are much too low to permit accurate estimates of the number of feedlots in the size groups designated for large producers (700 and 1,000 head for dairy cattle and 5,000 head marketed for hogs).

The financial data for individual operators are generally not available for any of the segments. Investment values, operating costs and profitability had to be synthesized from studies published by universities and government agencies and supplemented by information from industry sources. The synthesized data are representative, but variations in management practices, technologies and geographic locations impose a serious limit in adapting the model feedlot synthesis to any given individual operation.

The time and budget constraints of this study did not permit segmentation of the eight feedlot segments into all of the major technologies and known management practices, nor did they allow adequate recognition of regional differences in operating costs and other economic factors. These variations were considered and incorporated into the synthesis as much as practicable, but obviously the model feedlots concept cannot overcome these limitations.

Too, the analysis could not adequately reflect vertical integration in the model feedlots. The relationship of the integrated feedlot to the total enterprise is a crucial variable in estimating such effects as required new investment for pollution control. An integrated corporation (such as a feedlot-meat packer) would view closure decisions somewhat differently than would a farmer-feeder operator.

The analysis of price effects posed special problems. Recently, livestock and grain prices have been subject to wide variations, creating uncertainty about future prices. In order to reflect "normal" feeding conditions, DPRA chose to base its impact analysis on 1971 average price conditions. How these conditions reflect future price-cost relationships is a matter of conjecture. Macro-economic effects of pollution control on the feedlot industry require much deeper study before price impacts can be adequately estimated. A significant variable is the unanswered question of whether or not the same effluent control standards will be imposed on small and large operations. This study assumed that small operators will be required to meet the same or similar standards. Until production effects are determined, however, price effects cannot be estimated accurately.

Other limitations of general accuracy are related to pollution control parameters. EPA furnished costs for the typical feedlot operations, and DPRA adjusted these costs to the various model feedlots included in this report. Alternate control technologies, which could have significant influence on costs, were beyond the scope of this study. Additionally, pollution control costs were based on market prices and on the assumption that the operator purchased materials and labor. This latter assumption was necessary to uniform analysis, but in practice, farmer-feeders may choose to design and install their own pollution control systems, a condition which would radically alter the economic impacts on their operation. Wide variations could occur for different operators with the same sized feedlot.

Finally, the estimates of the in-place pollution control technology furnished by EPA for the various industry segments may be unreliable, but it is doubtful that more reliable estimates can be developed.

Given these limitations, the impact analysis for the industry segments will have ranges of variation which reflect the general accuracy of the base data.

## B. Range of Variations

All costs of production and all financial data represented model production units.

Due to imperfect cost data and variations in costs, the profitability of individual production units may range ± 10 percent from model firm estimates.

Pollution control costs used were supplied by the Environmental Protection Agency and were assumed to reflect representative costs for production units throughout the U.S. In view of the considerations noted above, different technologies for effluent control are available and the systems actually used will vary nationwide. Pollution costs experienced by individual producers may vary by an estimated ± 20 percent. However, generally the investment in pollution abatement systems represents a relatively small percentage of the total feedlot investment and the range of estimated variation should not seriously affect the conclusions drawn in this report.

The price effects of pollution controls on individual producers were estimated by using a net present value concept. This required the use of an arbitrary discount rate designed to reflect the cost of capital which varies widely, probably by as much as ± 65 percent among operators. DPRA used a discount rate of 6.5 percent in calculating net present values before and after pollution controls. Price changes required to maintain profitability vary by ± 5 percent for each one percent interval in the discount rate (i.e., from 6.5 percent to 7.5 percent).

## C. Critical Assumptions

Throughout this report, assumptions used in segmenting the industry, constructing model feedlots and analyzing impacts have been noted. Some of the critical assumptions are summarized below. Changing any of these assumptions would naturally change the analysis.

### 1. Model Feedlots

The model feedlot configuration in each segment is assumed to be representative of all feedlots of that size in that segment. There are many variations in management practices, technologies and geographic factors for feedlots and in all cases, the models were chosen to represent a majority of producers in each segment.

### 2. Model Feedlot Pro Forma Statements

Revenues and costs were based on published reports (in most cases, issued in the 1960's). These data had to be adjusted to 1971 conditions, assuming that past relationships of cost inputs remained constant over time. The pro forma statements are assumed to be reasonable and representative of operations in 1971.

### 3. Prices and Inflation

Current prices in the livestock and feedgrains markets are distorted and may not be representative of future expectations. Price and cost data have been adjusted to 1971 values to represent more "normal" conditions.

The analysis of pollution control impacts assumes that prices and costs will respond to inflation at the same rate and with offsetting effects. All costs and prices do not rise at the same rate during inflation, but such a variable could not reasonably be incorporated into this analysis.

### 4. Pollution Control Technologies and Costs

Standard design and operating costs were assumed for the various control technologies for each segment. No allowance was made for other systems nor for the operator constructing the system himself.

### 5. Status of Current Effluent Controls

The percentages of operators in each segment with pollution control technology in place were furnished by EPA. These are assumed to reflect reasonably the current status of the industry.

### 6. Imposition of Pollution Controls on Large Operators

The analysis was based on the assumption that effluent control standards will be applied to producers, with one time capacity in excess of 1,000 animal units. With this assumption some curtailment of production by smaller producers of impacted sizes can be expected. It was further assumed that larger producers of the categories would expand to absorb these production losses. If this assumption proves improper, price, production and employment effects for large producers will change by some indeterminate magnitude, but the overall impact on the industry probably would not result in significant changes for large producers.

## D. Questions Remaining

More precise data on the number of producers in the various size categories in each segment are required to permit a more complete impact analysis. For each category, more reliable estimates of each of the following are also desirable:

- type of management system used
- age of feedlots and equipment
- site data to determine feedlots with available land for construction of effluent control facilities adjacent to existing operations
- structural changes in the various segments
- economic data on duck and sheep segments
- application of effluent control standards to small producers outside the scope of this study

- family labor inputs into feedlot operations
- opportunity costs for land utilized in the base operation and for effluent controls
- future developments in government policies, international trade and related macro-economic topics which will influence price-cost and supply-demand relationships

These and other questions require much research and analysis beyond the scope of this study. Some matters probably fall into the realm of prophecy and conjecture, but reliable estimates are still necessary to accurately evaluate the eventual impact of pollution controls.

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